THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Appellants:	Riviere et al.
Appl. No.:	10/802,865
Conf. No.:	5444
Filed:	March 18, 2004
Title:	FROZEN DESSERT, PROCESS FOR PRODUCING IT AND CONTAINER FOR PACKAGING AND DISTRIBUTING IT
Art Unit:	1794
Examiner:	J. Chawla
Docket No.:	112701-586

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

APPELLANTS' APPEAL BRIEF

Sir:

Appellants submit this Appeal Brief in support of the Notice of Appeal filed on November 3, 2008. This Appeal is taken from the Final Rejections in the Office Action dated August 7, 2008.

I. REAL PARTY IN INTEREST

The real party in interest for the above-identified patent application on Appeal is Nestec S.A. by virtue of an Assignment dated March 9, 2004 and recorded at reel 015113, frame 0335 in the United States Patent and Trademark Office.

II. RELATED APPEALS AND INTERFERENCES

Appellants' legal representative and the Assignee of the above-identified patent application do not know of any prior or pending appeals, interferences or judicial proceedings which may be related to, directly affect or be directly affected by or have a bearing on the Board's decision with respect to the above-identified Appeal.

III. STATUS OF CLAIMS

Claims 1-5 and 7-27 are pending in the above-identified patent application. Claims 6 and 28 were previously canceled. Claims 17-27 were previously withdrawn. Claims 1-5 and 7-16 stand rejected. Therefore, Claims 1-5 and 7-16 are being appealed in this Brief. A copy of the appealed claims is included in the Claims Appendix.

IV. STATUS OF AMENDMENTS

A Non-Final Office Action was mailed on January 11, 2008. In the Non-Final Office Action, the Patent Office withdrew its previous rejections under 35 U.S.C. §112, first paragraph, but maintained its previous grounds of rejection under 35 U.S.C. §112, second paragraph, and 35 U.S.C. §103. Appellants filed a response to the Non-Final Office Action on May 9, 2008. In the response, Appellants amended Claims 1 and 7. A Final Office Action was mailed on August 7, 2008. In the Final Office Action, the Patent Office withdrew two of its grounds of rejection under 35 U.S.C. §112, second paragraph, but maintained one ground of rejection under 35 U.S.C. §112, second paragraph, as well as the obviousness rejections. Appellants filed a Notice of Appeal on November 3, 2008 with respect to the Final Office Action mailed on August 7, 2008. Copies of the Non-Final Office Action mailed on January 11, 2008 and the Final Office Action mailed on August 7, 2008 are attached as Exhibits A and B, respectively, in the Evidence Appendix.

V. SUMMARY OF CLAIMED SUBJECT MATTER

A summary of the invention by way of reference to the specification and/or figures for each of the independent claims is provided as follows:

Independent Claim 1 recites a frozen dessert composition (page 1, paragraph 2, lines 2-20) comprising frozen water (paragraph 6, lines 3-7), proteins (pages 3-4, paragraph 28, lines 10-24), fat (page 3, paragraph 26, lines 3-21), a sweetening agent mixture (page 2, paragraph 19, lines 1-11; page 3, paragraph 21) and at least one stabilizing agent (page 2, paragraph 16; paragraph 17, lines 10-11; pages 4-5, paragraph 51), wherein at least 90% by weight of the sweetening agent mixture comprises glucose polymers and glucose (page 2, paragraph 19, lines 1-11), the glucose polymers comprising n molecules of glucose, wherein n is an integer between 2 and 10, inclusive (page 2, paragraph 19, lines 8-11; page 3, paragraph 21, lines 23-26), with the glucose polymers representing from 10 to 50% of the weight of the sweetening agent mixture (page 2, paragraph 19, lines 1-11; paragraph 20, lines 1-16), wherein the sweetening agent mixture constitutes from 6 to 30% of the total weight of the frozen dessert composition (page 1, paragraph 9, lines 3-7; page 3, paragraph 22, lines 7-11) and wherein the stabilizing agent comprises a nucleating agent (page 2, paragraph 16, lines 9-16; pages 4-5, paragraph 51) for water crystals during freezing of the frozen dessert composition so that the composition, independently of any incorporation of gas, is malleable (page 2, paragraph 19; page 3, paragraph 21, lines 1-23; paragraph 28, lines 1-10) and extrudable (page 2, paragraph 19; page 4, paragraphs 45-48); at freezing temperatures (page 2, paragraph 15; page 4, paragraphs 35 and 41; page 5, paragraph 61, lines 2-5).

Although specification citations are given in accordance with C.F.R. 1.192(c), these reference numerals and citations are merely examples of where support may be found in the specification for the terms used in this section of the Brief. There is no intention to suggest in any way that the terms of the claims are limited to the examples in the specification. As demonstrated by the reference numerals and citations, the claims are fully supported by the specification as required by law. However, it is improper under the law to read limitations from the specification into the claims. Pointing out specification support for the claim terminology as is done here to comply with rule 1.192(c) does not in any way limit the scope of the claims to those examples from which they find support. Nor does this exercise provide a mechanism for

circumventing the law precluding reading limitations into the claims from the specification. In short, the reference numerals and specification citations are not to be construed as claim limitations or in any way used to limit the scope of the claims.

VI. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

1. Claims 1-5 and 7-16 are rejected under 35 U.S.C. §112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which Appellants regard as the invention.

2. Claims 1-5, 7 and 9-16 are rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent No. 5,084,295 to Whelan et al. ("*Whelan*") in view of U.S. Patent No. 3,128,193 to Hilker ("*Hilker*"). Copies of *Whelan* and *Hilker* are attached herewith as Exhibits C-D, respectively, in the Evidence Appendix.

3. Claim 8 is rejected under 35 U.S.C. §103(a) as being unpatentable over *Whelan* in view of *Hilker* and further in view of U.S. Patent No. 4,452,824 to Cole et al. ("*Cole*"). A copy of *Cole* is attached herewith as Exhibit E in the Evidence Appendix.

4. Claims 1-5 and 8-16 are rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent No. 4,427,701 to Morley ("*Morley*") in view of *Cole*. A copy of *Morley* is attached herewith as Exhibit F in the Evidence Appendix.

VII. ARGUMENT

A. LEGAL STANDARDS

1. Definiteness under 35 U.S.C. § 112, second paragraph

The standard for determining whether the definitiveness requirement is met under 35 U.S.C. § 112, ¶ 2 is "whether those skilled in the art would understand what is claimed when the claim is read in light of the Specification." *Orthokinetics Inc. v. Safety Travel Chairs Inc,* 1 U.S.P.Q. 2d 1081-1088 (Fed. Cir. 1986). "If the claims, read in light of the Specification, reasonably apprise those skilled in the art both of the utilization and scope of the invention, and if the language is as precise as the subject matter permits, the Courts can demand no more." *North American Vaccine Inc. v American Cyanamid Co.,* 28 U.S.P.Q. 2d 1333, 1339 (Fed. Cir. 1993). In this regard, "[p]atent law allows the inventor to be his own lexicographer ... [T]he specification aids in ascertaining the scope and meaning of the language employed in the claims inasmuch as words must be used in the same way in both the claims and the specification. *United States v. Teletronics, Inc.,* 8 U.S.P.Q. 2d 1217, 1220,(Fed. Cir. 1988). By statute, 35 U.S.C. 112, Congress has placed no limitations on how an applicant claims his invention, so long as the specification concludes with claims which particularly point out and distinctly claim that invention." *In re Pilkington,* 162 U.S.P.Q. 145, 148 (C.C.P.A. 1996).

2. Obviousness under 35 U.S.C. §103

The Federal Circuit has held that the legal determination of an obviousness rejection under 35 U.S.C. § 103 is:

> whether the claimed invention as a whole would have been obvious to a person of ordinary skill in the art at the time the invention was made...The foundational facts for the prima facie case of obviousness are: (1) the scope and content of the prior art; (2) the difference between the prior art and the claimed invention; and (3) the level of ordinary skill in the art...Moreover, objective indicia such as commercial success and long felt need are relevant to the determination of obviousness...Thus, each obviousness determination rests on its own facts.

In re Mayne, 41 U.S.P.Q. 2d 1451, 1453 (Fed. Cir. 1997).

In making this determination, the Patent Office has the initial burden of proving a *prima facie* case of obviousness. *In re Rijckaert*, 9 F.3d 1531, 1532, 28 U.S.P.Q. 2d 1955, 1956 (Fed. Cir. 1993). This burden may only be overcome "by showing some objective teaching in the prior art or that knowledge generally available to one of ordinary skill in the art would lead that individual to combine the relevant teachings." *In re Fine*, 837 F.2d 1071, 1074, 5 U.S.P.Q. 2d 1596, 1598 (Fed. Cir. 1988). "If the examination at the initial stage does not produce a prima facie case of unpatentability, then without more the applicant is entitled to grant of the patent." *In re Oetiker*, 24 U.S.P.Q. 2d 1443, 1444 (Fed. Cir. 1992).

Moreover, the Patent Office must provide explicit reasons why the claimed invention is obvious in view of the prior art. The Supreme Court has emphasized that when formulating a rejection under 35 U.S.C. § 103(a) based upon a combination of prior art elements it remains necessary to identify the reason why a person of ordinary skill in the art would have combined the prior art elements in the manner claimed. *KSR v. Teleflex*, 127 S. Ct. 1727 (2007).

Of course, references must be considered as a whole and those portions teaching against or away from the claimed invention must be considered. *Bausch & Lomb, Inc. v. Barnes-Hind/Hydrocurve Inc.*, 796 F.2d 443 (Fed. Cir. 1986). "A prior art reference may be considered to teach away when a person of ordinary skill, upon reading the reference would be discouraged from following the path set out in the reference, or would be led in a direction divergent from the path that was taken by the Applicant." *Monarch Knitting Machinery Corp. v. Fukuhara Industrial Trading Co., Ltd.*, 139 F.3d 1009 (Fed. Cir. 1998), quoting, *In re Gurley*, 27 F.3d 551 (Fed. Cir. 1994).

Further, the Federal Circuit has held that it is "impermissible to use the claimed invention as an instruction manual or 'template' to piece together the teachings of the prior art so that the claimed invention is rendered obvious." *In re Fritch*, 23 U.S.P.Q.2d 1780, 1784 (Fed. Cir. 1992). "One cannot use hindsight reconstruction to pick and choose among isolated disclosures in the prior art to deprecate the claimed invention." *In re Fine*, 837 F.2d 1071 (Fed. Cir. 1988).

B. THE CLAIMED INVENTION

Independent Claim 1 recites, in part, a frozen dessert composition comprising frozen water, proteins, fat, a sweetening agent mixture and at least one stabilizing agent. At least 90% by weight of the sweetening agent mixture comprises glucose polymers and glucose. The

glucose polymers comprise n molecules of glucose, wherein n is an integer between 2 and 10, inclusive, and represent from 10 to 50% of the weight of the sweetening agent mixture. Furthermore, the sweetening agent mixture constitutes from 6 to 30% of the total weight of the frozen dessert composition. The stabilizing agent comprises a nucleating agent for water crystals during freezing of the frozen dessert composition. The nucleating agent ensures that the composition, independently of any incorporation of gas, is malleable and extrudable at freezing temperatures.

C. CLAIMS 1-5 AND 7-16 ARE SUFFICIENTLY DEFINITE TO SATISFY THE REQUIREMENTS UNDER 35 U.S.C. §112, SECOND PARAGRAPH

The standard for determining whether the definitiveness requirement is met under 35 U.S.C. §112, second paragraph, is whether those skilled in the art would understand what is claimed when the claim is read in light of the specification. The Patent Office asserts that the terms "malleable" and "extrudable" in independent Claim 1 are indefinite because such terms are relative and it is "unclear. . . what standard of malleability or extrusion is employed to establish if a frozen dessert product is adequately malleable or extrudable." See, Final Office Action, page 2, lines 18-24. However, Appellants respectfully submit that one skilled in the art would understand the scope of the claim terms "malleable" and "extrudable" when read in view of the specification.

For example, when describing the benefits of the claimed composition, the Specification expressly states:

> "it is possible to reduce the proportion of fat in a frozen dessert. . . without as a result limiting the malleability. . . . It was therefore observed that the presence. . . of these glucose polymers makes it possible to avoid or reduce the greasy taste of the frozen dessert. . . without as a result reducing, at the freezing temperature, its spoonable character and its capacity to be distributed by the nozzle of a pressurized container."

See, Specification, page 2, paragraph 19, lines 2-17. This passage describes the malleability as being sufficient to impart a "spoonable character" to the frozen dessert. Furthermore, one of skill in the art would understand that the "capacity to be distributed by the nozzle of a pressurized container" describes the extrudability of the dessert. This understanding of "extrudability" is further supported by the fact that the term "extrudable" is defined as capable of

being forced, pressed or pushed out of an object. See, http://www.merriam-webster.com/dictionary/extrudable. The Specification also states that "the dessert according to the invention [] possesses. . . malleability at a temperature of less than -15° C." See, Specification, page 5, paragraph 61, lines 2-5. One of skill in the art would thus understand that a dessert in accordance with the present claims would be sufficiently "malleable" if it were malleable in that temperature range. Moreover, the Specification explicitly notes that "a sufficient malleability of the dessert according to the invention. . . is obtained when the protein level in the composition is between 3 and 18% relative to the total weight of the composition." See, Specification, page 3, paragraph 28, lines 2-6. As such, one of skill in the art reading the claims in view of the specification would understand the scope of the terms "malleable" and "extrudable."

Contrary to the Patent Office's assertion, see, Final Office Action, page 2, lines 18-21, "malleable" and "extrudable" are not indefinite merely because they may be considered "relative terms." In fact, the Federal Circuit has established that merely because "some claim language may not be precise [] does not automatically render a claim invalid. When a word of degree is used the district court must determine whether the patent's specification provides some standard for measuring that degree." *Seattle Box Co., Inc. v. Indus. Crating & Packing, Inc.*, 731 F.2d 818, 826 (Fed. Cir. 1984) (emphasis added). As discussed previously, the Specification provides one of skill in the art with standards for measuring the degree of malleability and extrudability required by the claims.

The Patent Office further asserts that Appellants' arguments regarding the limitations on the degree of malleability and extrudability required by the claims are not persuasive because such limitations are not recited in the claims. See, Final Office Action, page 13, lines 6-25. In support of its assertion, the Patent Office argues that "[a]lthough the claims are interpreted in light of the specification, limitations from the specification are not read into the claims." See, Final Office Action, page 13, lines 26-28. However, the Federal Circuit has specifically held that "[t]he standard of indefiniteness is somewhat high; a claim is not indefinite merely because its scope is not ascertainable from the face of the claims." *Amgen Inc. v. Hoechst Marion Roussel, Inc.*, 314 F.3d 1313, 1342 (Fed. Cir. 2003) (emphasis added). "[C]laims are not indefinite merely because they present a difficult task of claim construction. Instead, '[i]f the meaning of the claim is discernible, even though the task may be formidable and the conclusion

may be one over which reasonable persons will disagree, we have held the claim sufficiently clear to avoid invalidity on indefiniteness grounds." *Halliburton Energy Servs., Inc. v. M-I LLC*, 514 F.3d 1244, 1249 (Fed. Cir. 2008) (citation omitted). Furthermore, the standard for indefiniteness is clear: "If one skilled in the art would understand the bounds of the claim when read in light of the specification, then the claim satisfies section 112 paragraph 2." Thus, Appellants respectfully submit that the limitations in the Specification are relevant to determining indefiniteness. Moreover, as discussed previously, one of skill in the art reading the claims in view of the specification would understand the scope of the terms "malleable" and "exrudable." Therefore, independent Claim 1 and Claims 2-5 and 7-16 that depend therefrom are not indefinite.

Accordingly, Appellants respectfully request that the rejection of Claims 1-5 and 7-16 under 35 U.S.C. §112, second paragraph be withdrawn.

D. THE REJECTION OF CLAIMS 1-5, 7 AND 9-16 UNDER 35 U.S.C. §103(a) TO *WHELAN* AND *HILKER* SHOULD BE REVERSED BECAUSE THE PATENT OFFICE HAS NOT ESTABLISHED A *PRIMA FACIE* CASE OF OBVIOUSNESS

Appellants respectfully submit that, even if combinable, the cited references fail to disclose or suggest every element of the presently pending claims. Independent Claim 1 recites, in part, a frozen dessert composition comprising frozen water, proteins, fat, a sweetening agent mixture and at least one stabilizing agent, wherein at least 90% by weight of the sweetening agent mixture comprises glucose polymers and glucose, the glucose polymers comprising n molecules of glucose, wherein n is an integer between 2 and 10, inclusive, with the glucose polymers representing from 10 to 50% of the weight of the sweetening agent mixture. When a sweetening mixture comprising glucose and glucose polymers in the claimed range is used, it is possible to reduce the greasy taste of the frozen dessert by substituting some of the fat with milk fat without affecting the malleability and extrudability of the frozen dessert. See, Specification, page 2, paragraphs 20-21. In contrast, even if combinable, the cited references fail to teach or suggest a frozen dessert composition: (1) wherein at least 90% by weight of the sweetening agent mixture comprises glucose polymers and glucose; and (2) with the glucose polymers

representing from 10 to 50% of the weight of the sweetening agent mixture for at least the reasons set forth below.

1. Even if combinable, the cited references do not teach or suggest that the glucose polymers represent from 10 to 50% of the weight of the sweetening agent mixture

Appellants respectfully submit that, even if combinable, the cited references fail to disclose or suggest a frozen dessert composition with the glucose polymers representing from 10 to 50% of the weight of the sweetening agent mixture as required, in part, by independent Claim 1 and Claims 2-5, 7 and 9-16 that depend therefrom. The Patent Office alleges that *Whelan* discloses a sweetening mixture in which glucose polymers comprise approximately 10% of the total amount of sweetener and, thus, falls within Appellants' claimed range. See, Final Office Action, page 4, lines 16-30; page 5, lines 1-7. However, as will be explained below in further detail, the portion of *Whelan* relied on by the Patent Office merely discloses, at best, a sweetening mixture in which glucose polymers comprise only 8 weight% of the sweetening agent mixture. See, *Whelan*, Example 1. Nowhere does *Whelan* disclose or suggest that its sweetening agent contains 10 to 50% by weight of glucose polymers. This is further evidenced by the fact that *Whelan* never uses the term "glucose polymers" in its disclosure and fails to recognize the importance of using the claimed amount of glucose polymers in its sweetening agent mixture to reduce the greasy taste of the frozen dessert without reducing its malleability and extrudability.

The Patent Office asserts that Example 1 of *Whelan* discloses a sweetening mixture comprising 10% by weight of glucose polymers. See, Final Office Action, page 4, lines 16-30. However, the Patent Office bases its calculation on incorrect assumptions regarding the corn syrup of *Whelan*. For example, the Patent Office states that Whelan teaches a sweetener comprising 1.87% + 0.6% of dry sucrose, 14.93% of liquid sugar and 2.98% of 62 DE corn syrup in a composition of 200%. See, Final Office Action, page 4, lines 25-27. However, the 1.87% of dry sucrose is included in the preemulsion mixture, which comprises only 21.38% of the final composition. See, *Whelan*, Example 1. Thus, the correct amount of dry sucrose in the final frozen dessert composition is 1.87% * .2138 + 0.6% = 1%. The total weight % of sweetening mixture in the final composition is then 1% + 14.93% + 2.98% = 18.91%. Therefore,

the 62 DE corn syrup comprises approximately 15.76% of the sweetening mixture. The Patent Office asserts that since 62 DE corn syrup comprises 61-64% glucose polymers, approximately 10% (.64 * 15.76%) of the sweetening mixture is glucose polymers. See, Final Office Action, page 5, lines 16-30. However, the Patent Office ignores the fact that 62 DE corn syrup comprises 61-64% glucose polymers on a dry weight basis. See, Handbook of Industrial Chemistry, page 188; http://www.answers.com/topic/dextrose-equivalent-value (stating that DE values are the percent of total solids that have been converted to reducing sugars). It is well known by one of skill in the art that corn syrup generally comprises 20% by weight of water. See, International Application No. WO 95/13710, page 12, lines 21-23; http://www.calorie-counter.net/toppings-calories/corn-syrup.htm. Therefore, since the 61-64% glucose polymers merely comprise 80% of the corn syrup, only 8 % (.64 * .80 * 15.76) of the sweetening mixture comprises glucose polymers. Furthermore, the Patent Office fails to cite additional support in *Whelan*, other than Example 1, for the claimed element. As such, *Whelan* does not disclose a frozen dessert composition with the glucose polymers representing from 10 to 50% of the weight of the sweetening agent mixture as required, in part, by the present claims.

Hilker also fails to disclose or suggest a frozen dessert composition in which glucose polymers represent from 10 to 50% of the weight of the sweetening agent mixture. *Hilker* never expressly discloses that its sweetening agent mixture contains between 10 and 50 weight % of glucose polymers. Nevertheless, the Patent Office relies on *Hilker* for the disclosure of a sweetening agent mixture comprising glucose and glucose polymers in the claimed range. See, Final Office Action, page 5, lines 27-29. The portions of *Hilker* cited by the Patent Office merely disclose sweetening agent mixtures comprising: (1) 10% sucrose and 7.5% "corn syrup solids"; and (2) 12% sucrose and 8% "corn syrup solids." See, *Hilker*, column 3, lines 54-58; column 4, lines 26-31. The corn syrup solids thus comprise only 40-42% of the sweetening agent mixture.

In support of its assertion, the Patent Office argues that corn syrup solids include a low amount of glucose and a high amount of glucose polymers such as dextrins and maltodextrins. See, Final Office Action, page 6, lines 2-8. However, the Patent Office fails to cite support for such statement. Furthermore, at least one source states that to qualify as corn syrup solids, "the glucose (dextrose) content must be at least 88% of the weight of the concentrated syrup." See, http://www.sugar.org/consumers/sweet_by_nature.asp?id=277. Thus, contrary to the Patent

Office's assertion, the glucose content in corn syrup solids may be very high, indicating a low glucose polymer content. Because the corn syrup solids themselves comprise only 40-42 weight % of the sweetening agent mixture, if the glucose content is greater than 77% of the corn syrup solids, the glucose polymers will comprise less than 10% of the sweetening agent mixture.

Moreover, *Hilker* fails to disclose the specific weight percentages of glucose polymers in its corn syrup solids. The Sugar Association states that "when a corn syrup has been concentrated to contain less than 10% water, it can be listed as 'corn syrup solids' in an ingredient statement." See, http://www.sugar.org/consumers/sweet_by_nature.asp?id=277. Because the solid portion of corn syrup can contain anywhere from 1% glucose (20 DE) to 96% of glucose (97 DE), the weight percentage of glucose polymers in a given corn syrup solids composition will vary. See, Handbook of Industrial Chemistry, page 188. As such, because *Hilker* fails to disclose the portion of glucose polymers in its corn syrup solids composition or the DE value of its corn syrup solids composition, *Hilker* fails to disclose that the glucose polymers represent from 10 to 50% of the weight of the sweetening agent mixture in accordance with the present claims. Thus, the cited references fail to disclose or suggest a frozen dessert composition with the glucose polymers representing from 10 to 50% of the weight of the sweetening agent mixture as required, in part, by Claims 1-5 and 9-16.

2. Even if combinable, the cited references also fail to teach or suggest that at least 90% by weight of the sweetening agent mixture comprises glucose polymers and glucose

Appellants respectfully submit that, even if combinable, the cited references also fail to disclose or suggest a frozen dessert composition wherein at least 90% by weight of the sweetening agent mixture comprises glucose polymers and glucose as required, in part, by independent Claim 1 and Claims 2-5 and 9-16 that depend therefrom. The Patent Office asserts that *Whelan* reads on the claimed range merely because *Whelan* discloses glucose, sucrose, invert sugar, maltose, corn syrup and high maltose corn syrup as sources of carbohydrate sweeteners whose amounts can be varied based on the desired calorie reduction benefit. See, Final Office Action, page 5, lines 15-26. However, nowhere does *Whelan* disclose that at least

90% by weight of its sweetening agent mixture comprises glucose polymers and glucose, nor does the Patent Office cite support for such claimed element.

Instead, the Patent Office asserts that increasing the amount of glucose and glucose polymers in a sweetener mixture is simply a matter of judicious selection of a known component already disclosed in the composition and, thus, would have been obvious to one of skill in the art. See, Final Office Action, page 14, lines 7-18. The Patent Office cites *In re Levin* in support of the proposition that a claimed range of an ingredient is not patentable unless the applicant demonstrates that the claimed range produces a new, unexpected and useful function. See, Final Office Action, page 6, lines 22-30; page 7, lines 1-3. However, Appellants respectfully submit that providing a sweetening mixture that comprises glucose and glucose polymers in the claimed range provides unexpected results over prior art ranges. For example, when at least 90% by weight of a sweetening mixture consists of glucose and glucose polymers, the glucose polymers comprising 10% to 50% by weight of the mixture, it is surprisingly possible to reduce the fat quantity used in the composition without limiting the malleability of the dessert at the freezing temperature. See, Specification, page 2, paragraph 19, lines 1-11. Furthermore, by using the claimed range of glucose and glucose polymers in the sweetening mixture, the nature of the fat in the composition is modified such that it becomes possible to use a certain amount of fat, such as that of whole milk, with an onset of solidification temperature between 0° and 40° C. See, Specification, page 2, paragraph 20, lines 1-16. Therefore, providing a sweetening mixture in the claimed range provides useful and unexpected functions over prior art frozen desserts. As such, one of ordinary skill in the art at the time of the invention would not have been motivated to use the claimed range of glucose and glucose polymers and, as such, the sweeteners of *Whelan* do not render the claimed sweetening mixture obvious.

Hilker also fails to disclose a sweetening mixture which comprises at least 90% by weight of glucose polymers and glucose. The Patent Office asserts that *Hilker* teaches the claimed sweetening mixture merely because it discloses sucrose and corn syrup solids as sweetening agents used in its composition. See, Final Office Action, page 6, lines 2-11. The Patent Office supports its assertion by arguing that, since sucrose is a polymer comprising glucose and corn syrup solids consist of glucose and glucose polymers, *Hilker* discloses a sweetening agent mixture comprising up to 100% of glucose and glucose polymers. See, Final Office Action, page 6, lines 4-10. However, contrary to the Patent Office's assertion, sucrose is

not a glucose polymer but rather a disaccharide of glucose and fructose. See, http://en.wikipedia.org/wiki/Sucrose. Independent Claim 1 clearly recites that its glucose polymers comprise "n molecules of glucose, wherein n is an integer between 2 and 10." In contrast, sucrose consists of only one molecule of glucose and one molecule of fructose. See, http://en.wikipedia.org/wiki/Sucrose; http://en.wikipedia.org/wiki/Disaccharide. As such, sucrose is not glucose or a glucose polymer. Furthermore, since sucrose comprises more than 50% of the sweetening mixture of *Hilker*, *Hilker* fails to disclose or suggest a sweetening agent mixture wherein at least 90% by weight of the sweetening agent mixture comprises glucose polymers and glucose.

The Patent Office further asserts that the claims do not require the at least 90% of the sweetening mixture to consist only of glucose and glucose polymers. See, Final Office Action, page 10, lines 1-7. However, Appellants respectfully submit that the context of Claim 1 clearly indicates that the at lest 90% of the sweetening agent mixture must consist only of glucose polymers and glucose. For example, because Claim 1 states that at least 90% of the mixture comprises glucose and glucose polymers, the claim leaves open the possibility that up to 10% of the mixture can include other components. As such, reading the claim in the manner proposed by the Patent Office would render the at least 90% language superfluous. Specifically, if Claim 1 were read to include at least 90% of glucose polymers, glucose and anything else, there would be no need to recite that at least 90% comprises glucose and glucose polymers. Instead, Claim 1 could simply recite that the mixture comprises glucose and glucose polymers, since anything else that could be included in the composition would create a composition comprising 100% (which is at least 90%) of the glucose, glucose polymers, and anything else. "'[C]laims are interpreted with an eye toward giving effect to all terms in the claim,'" and as such, the claims must be construed so as to not render a claim limitation functionally meaningless. *Cat Tech LLC v. TubeMaster, Inc.*, 528 F.3d 871, 885 (Fed. Cir. 2008). Because the Patent Office's proposed interpretation of Claim 1 would render the limitation at least 90% meaningless, Appellants respectfully submit that the proper interpretation of Claim 1 requires that at lest 90% of the sweetening agent mixture consist only of glucose polymers and glucose. In contrast, as discussed previously, at least 50% of *Hilker*'s sweetening agent mixture consists of sucrose. As such, both *Hilker* and *Whelan* fail to disclose a sweetening agent mixture wherein at least 90%

by weight of the sweetening agent mixture comprises glucose polymers and glucose in accordance with the present claims.

For the reasons discussed above, Appellants respectfully submit that Claims 1-5 and 9-16 are novel, nonobvious and distinguishable from the cited references.

Accordingly, Appellants respectfully request that the rejection of Claims 1-5 and 9-16 under 35 U.S.C. §103(a) to *Whelan* and *Hilker* be withdrawn.

E. THE REJECTION OF CLAIM 8 UNDER 35 U.S.C. §103(a) TO *WHELAN, HILKER* AND *COLE* IS IMPROPER IN VIEW OF THE PATENTABILITY OF INDEPENDENT CLAIM 1

Claim 8 is rejected under 35 U.S.C. §103(a) as being unpatentable over *Whelan*, *Hilker*, and *Cole*. Appellants respectfully submit that the patentability of Claim 1 over *Whelan* and *Hilker* as discussed previously renders moot the obviousness rejection of Claim 8 that depends from Claim 1. In this regard, the cited art fails to teach or suggest the elements of Claim 8 in combination with the novel elements of Claim 1.

For example, the Patent Office alleges that "*Cole* teaches a soft frozen dessert comprising low molecular weight polyhydric alcohols such as glycerol at a level of 1% to 5%. . . [and] further teaches that glycerol in the amount taught functions as [a] freezing point depressant[] to impart increased softness to a frozen product." See, Non-Final Office Action dated January 11, 2008, page 10, lines 19-23. However, as discussed previously, even if combinable, *Whelan* and *Hilker* fail to disclose a frozen dessert composition: (1) wherein at least 90% by weight of the sweetening agent mixture comprises glucose polymers and glucose; and (2) with the glucose polymers representing from 10 to 50% of the weight of the sweetening agent mixture as required, in part, by Claim 8. Therefore, *Cole* does not cure the deficiencies of *Whelan* and *Hilker* and does not teach or suggest the required elements of Claim 8 that depends from Claim 1.

For the reasons discussed above, Appellants respectfully submit that Claim 8 is novel, nonobvious and distinguishable from the cited references.

Accordingly, Appellants respectfully request that the rejection of Claims 8 under 35 U.S.C. §103(a) to *Whelan*, *Hilker* and *Cole* be withdrawn.

F. THE REJECTION OF CLAIMS 1-5 AND 8-16 UNDER 35 U.S.C. §103(a) TO *MORLEY* AND *COLE* SHOULD BE REVERSED BECAUSE THE PATENT OFFICE HAS NOT ESTABLISHED A *PRIMA FACIE* CASE OF OBVIOUSNESS

Appellants respectfully submit that, even if combinable, the cited references fail to disclose or suggest that at least 90% by weight of the sweetening agent mixture comprises glucose polymers and glucose as required, in part, by independent Claim 1 and Claims 2-5 and 8-16 that depend therefrom. The Patent Office admits that "*Morley* is silent about glucose polymers and glucose comprising at least 90% of the sweetening agent mixture." See, Final Office Action, page 10, lines 16-18. Nevertheless, the Patent Office asserts that it would have been obvious to vary the amount of sweetener based on the sweetness intensity of the particular sweetener and the desired sweetness of the product. See, Final Office Action, page 10, lines 18-20. However, the claimed range of sweeteners surprisingly produces results that do not relate to the mere sweetness of the composition but rather result in a change in the nature of the fat used in the composition. See, Specification, page 2, paragraph 19, lines 1-6. As discussed previously, this change in the nature of the fat produces the unexpected result of being able to use a certain amount of fat, such as that of whole milk, with an onset of solidification temperature between 0° and 40° C, without affecting the malleability of extrudability of the composition. In contrast, prior art sweetening mixtures produced compositions which required the use of fat only with an onset of solidification temperature below 0° C. See, Specification, page 2, paragraph 20, lines 6-16. As such, one of ordinary skill in the art would not have arrived at the claimed range of glucose and glucose polymers as a matter of routine experimentation.

The Patent Office asserts that *Cole* discloses soft frozen dessert compositions consisting entirely of corn syrup solids and dextrose and, thus, a sweetening mixture comprising at least 90% by weight of glucose and glucose polymers. See, Final Office Action, page 10, lines 21-28. However, the portion of *Cole* relied on by the Patent Office merely discloses a series of "formulations" with various saccharide distributions. See, *Cole*, Column 7, lines 10-68; column 8, lines 1-13; Tables 1-3. Nowhere does *Cole* disclose that these "formulations" consist entirely of glucose and glucose polymers, or that the "saccharide distribution" represents the weight % of sweeteners used in the dessert composition. Furthermore, the specific runs cited by the Patent Office (89 and 91-92) merely disclose that the saccharide distribution includes dextrose and

certain "disaccharides" and "higher saccharides." See, *Cole*, Table 2. For example, run 89 includes 11.45% of dextrose (glucose), 1.58% of maltose. 5.5% lactose and 17.58% (7.08% "total disaccharides" and 10.00% "higher saccharides") of some undisclosed compounds that may or may not include glucose polymers. Furthermore, as discussed previously, disaccharides are not considered "glucose polymers" in accordance with the present claims. As such, at least 20% of the composition of run 89 is not glucose or a glucose polymer. Moreover, an additional 28% of the composition of run 89 (the "higher saccharides") includes undisclosed compounds that may or may not be glucose polymers. Therefore, run 89 does not disclose a composition comprising at least 90% by weight of glucose and glucose polymers. Similarly, runs 91 and 92 include sweetening compositions: (1) with at least 17% (9.55% / (9.55% + 21.00% + 5.5%+ 1.58% + 7.08% + 10.00%)) and 12% (4.78% / (4.78% + 11.45% + 5.5%+ 1.58% + 7.08% + 10.00%)), respectively, of glycerol; and (2) with at least 13% (7.08% / (9.55% + 21.00% + 5.5%+ 1.58% + 7.08% + 10.00%) and 18% (7.08% / (4.78% + 11.45% + 5.5%+ 1.58% + 7.08% + 10.00%)), respectively, of disaccharides. See, *Cole*, Table 2. As such, runs 91 and 92 also fail to disclose the claimed sweetening mixture. In fact, *Cole* expressly discloses that its carbohydrate mixture may contain up to 7% of sugar alcohols such as sorbitol and mannitol, as well as up to 5% of polyhydric alcohols such as glycerol, leaving up to at least 12% of the mixture without glucose and glucose polymers. See, *Cole*, column 2, lines 23-38; Claims 1 and 6-7. As such, both Morley and Cole fail to disclose a frozen dessert composition wherein at least 90% by weight of the sweetening agent mixture comprises glucose polymers and glucose as required, in part, by independent Claim 1 and Claims 2-5 and 8-16 that depend therefrom.

For the reasons discussed above, Appellants respectfully submit that Claims 1-5 and 7-16 are novel, nonobvious and distinguishable from the cited references.

Accordingly, Appellants respectfully request that the rejection of Claims 1-5 and 7-16 under 35 U.S.C. §103(a) to *Morley* and *Cole* be withdrawn.

VIII. CONCLUSION

Appellants respectfully submit that the Patent Office has failed to meet the high standard for indefiniteness under 35 U.S.C. §112, second paragraph, with respect to the rejection of Claims 1-5 and 7-16. Furthermore, the Patent Office has failed to establish a *prima facie* case of obviousness under 35 U.S.C. §103 with respect to the rejection of Claims 1-5 and 7-16. Accordingly, Appellants respectfully submit that the indefiniteness and obviousness rejections are erroneous in law and in fact and should therefore be reversed by this Board.

The Director is authorized to charge $540 for the Appeal Brief and any additional fees which may be required, or to credit any overpayment to Deposit Account No. 02-1818. If such a withdrawal is made, please indicate the Attorney Docket No. 112701-586 on the account statement.

Respectfully submitted,

BELL, BOYD & LLOYD LLP

BY _____

Robert M. Barrett
Reg. No. 30,142
Customer No. 29157

Dated: December 9, 2008

CLAIMS APPENDIX

PENDING CLAIMS ON APPEAL OF U.S. PATENT APPLICATION SERIAL NO. 10/088,766

1. A frozen dessert composition comprising frozen water, proteins, fat, a sweetening agent mixture and at least one stabilizing agent, wherein at least 90% by weight of the sweetening agent mixture comprises glucose polymers and glucose, the glucose polymers comprising n molecules of glucose, wherein n is an integer between 2 and 10, inclusive, with the glucose polymers representing from 10 to 50% of the weight of the sweetening agent mixture, wherein the sweetening agent mixture constitutes from 6 to 30% of the total weight of the frozen dessert composition and wherein the stabilizing agent comprises a nucleating agent for water crystals during freezing of the frozen dessert composition so that the composition, independently of any incorporation of gas, is malleable and extrudable at freezing temperatures.

2. The dessert of claim 1, wherein the stabilizing agent comprises microcrystalline cellulose in an amount of from 0.1 to 1% by weight relative to the total weight of the composition.

3. The dessert of claim 1, wherein the frozen water is present in an amount of from 40 to 62% by weight relative to the total weight of the composition.

4. The dessert of claim 1, wherein the at least one stabilizing agent includes an emulsifier or thickener, with all stabilizing agents being present in an amount of from 0.3 to 2.7% by weight relative to the total weight of the composition.

5. The dessert of claim 4, wherein the thickener is carob gum, guar gum, a carragheenan, an alginate, gelatin, a carboxymethylcellulose (CMC) and the emulsifier is a mono or and diglycerides of a fatty acid, a sucroester or egg yolk.

7. The dessert of claim 1, further comprising a glucose syrup, wherein the glucose syrup comprises less than 1% by weight of fructose.

8. The dessert of claim 1, wherein the composition further comprises from 1 to 3% by weight of glycerol.

9. The dessert of claim 1, wherein fat is present in the composition in an amount of from 4 to 20% by weight relative to the total weight of the composition.

10. The dessert of claim 1, wherein the fat contains at least component selected from the group consisting of one fat of plant origin having an onset of solidification temperature of less than 0 °C , one or more fats of plant or animal origin having an onset of solidification temperature of between 0 and 40 °C and combinations thereof.

11. The dessert of claim 10, wherein the fat is chosen from the group consisting of sunflower oil, sunflower oil rich in oleic acid, grapeseed oil and a butter oil fraction.

12. The dessert of claim 1, wherein the proteins are present in an amount of from 3 to 18% by weight relative to the total weight of the composition.

13. The dessert of claim 12, wherein the proteins are proteins of plant origin or proteins of animal origin provided by whole, skimmed or partially lactose-free milk or a derivative of milk origin.

14. The dessert of claim 13, wherein the derivatives of milk origin are demineralized whey or demineralized and lactose-free whey.

15. The dessert of claim 13, wherein the proteins of plant origin are obtained from leguminous plants.

16. The dessert of claim 1, which further comprises adjuvants, flavoring inclusions or other preparations.

EVIDENCE APPENDIX

EXHIBIT A: Non-Final Office Action dated January 11, 2008

EXHIBIT B: Final Office Action dated August 7, 2008

EXHIBIT C: U.S. Patent No. 5,084,295 to Whelan et al. ("*Whelan*"), cited by the Patent Office in the Non-Final Office Action dated January 11, 2008 and the Final Office Action dated August 7, 2008

EXHIBIT D: U.S. Patent No. 3,128,193 to Hilker ("*Hilker*"), cited by the Patent Office in the Non-Final Office Action dated January 11, 2008 and the Final Office Action dated August 7, 2008

EXHIBIT E: U.S. Patent No. 4,452,824 to Cole et al. ("*Cole*"), cited by the Patent Office in the Non-Final Office Action dated January 11, 2008 and the Final Office Action dated August 7, 2008

EXHIBIT F: U.S. Patent No. 4,427,701 to Morley ("Morley"), cited by the Patent Office in the Non-Final Office Action dated January 11, 2008 and the Final Office Action dated August 7, 2008

RELATED PROCEEDINGS APPENDIX

None.

EXHIBIT A

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/802,865	03/18/2004	Philippe Jerome Didier Riviere	88265-7344	5444

29157 7590 01/11/2008

BELL, BOYD & LLOYD LLP
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EXAMINER	
CHAWLA, JYOTI	
ART UNIT	PAPER NUMBER
1794	

NOTIFICATION DATE	DELIVERY MODE
01/11/2008	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

PATENTS@BELLBOYD.COM

Office Action Summary	Application No.	Applicant(s)	
	10/802,865	RIVIERE ET AL.	
	Examiner	Art Unit	
	Jyoti Chawla	1794	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *October 30, 2007*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-5 and 7-27* is/are pending in the application.

4a) Of the above claim(s) *17-27* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-5 and 7-16* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/ are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

A request for continued examination under 37 CFR 1.114 dated October 30, 2007, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's claims filed October 30, 2007 has been entered. Claims 1, 3 and 7 have been amended, and claim 28 has been cancelled, claims 17-27 remain withdrawn from consideration pertaining to a non-elected invention. Claims 1-5, 7-16 remain pending and are examined in the application.

Claim Rejections - 35 USC § 112

Rejection of claims 1-5, 7-16 under 35 U.S.C. 112, first paragraph have been withdrawn in light of applicant's amendments filed October 30, 2007.

The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claim 1-5, 7-16 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claims 1 is indefinite for the recitation of "the sweetening agent mixture comprises at least 90% of its weight of a sweetening component comprising glucose polymers and glucose...with the glucose polymers representing from 10 to 50% of the weight of the sweetening agent mixture and the glucose representing from 30 to 40% of the weight of the sweetening agent mixture, wherein the sweetening component constitutes from 6 to 30% of the total weight of the frozen dessert ".

Thus as recited in the claim

i) at least 90% of the sweetening agent mixture is a sweetening component comprising glucose + glucose polymers and other sweeteners as the term comprising is open ended.

ii) the claim further states that the glucose polymers represent 10-50% of the sweetening agent mixture, and glucose polymers have 30-40% by weight as glucose,

Thus based on the above information it is unclear as to what sweeteners comprise at least 40 to 80% of the sweetening agent mixture. If at least 90% of the sweetener comprises of glucose and glucose polymers, then it is unclear as to what proportion of the sweetening mixture comes as glucose because based on claim recitation glucose is 30-40% of 10-50% of sweetening mixture as part of glucose polymers, i.e.. glucose is 3-20% of the sweetening mixture as part of glucose polymers. It is unclear as recited as to what is the proportion, if any, of glucose by itself as part of sweetening mixture. In the absence of this information the claim as recited is unclear for the purposes of prior art comparison.

Claim 1 is further unclear for the recitation of relative terms "malleable" and "extrudable", as stated in the previous office actions dated April 5, 2007 and October 19, 2007, it is not clear as to what is the freezing temperature range and what standard of malleability is employed to establish if a frozen dessert product is adequately malleable according to the claim as recited. For the purposes of prior art comparison a frozen dessert composition with microcrystalline cellulose would be considered appropriate to read upon the instantly claimed invention.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

(A) Claim 1-5, 7, 9-16 are rejected under 35 U.S.C. 103(a) as being obvious over Whelan et al (US 5,084,295) in view of Hilker (US 3128193).
The references and rejection are incorporated herein and as cited in the office action mailed October 19, 2007.

Regarding claim 1, Whelan et al, hereinafter Whelan, teaches a frozen dessert composition comprising of water, proteins, and fat, sweetening agents and stabilizing agents (Abstract and Column 6, lines 1-8, lines 31-38). Regarding the partially frozen water, Whelan teaches water, however, since the reference teaches a frozen dessert composition, the finished frozen product would comprise frozen water as recited. The sweetening agents as taught by Whelan include sucrose, glucose, fructose, maltose corn syrup, high fructose corn syrup, invert sugar, maple syrup, honey, brown sugar, refiner's syrup (i.e., liquid sugar or sucrose etc. Whelan further teaches addition of reduced calorie or no calorie sweeteners that replace the sweetening composition partially or completely (Column 12). The sweeteners taught by Whelan include glucose as discussed above and glucose polymers (corn syrup comprising dextrose/glucose) and polyols and high intensity sweeteners (Columns 8 and 12). Whelan teaches monosaccharides (glucose, mannose, galactose, fructose, sorbose (column 8, 46-47)) disaccharides (maltose, sucrose and lactose (Column 8, lines 51-53)), oligosaccharides and polysaccharides and sugar alcohols including those derived from xylose, arabinose,

ribose, methylglucoside (e.g., sorbitol, xylitol etc (Column 8, lines 25-38 and 48-50 and Column 12, lines 5-68)). The proportion of the nutritive or calorific sweetening mixture taught by Whelan comprises from about 10 to about 20% of the product (Column 12, lines 5-15) and the reduced calorie sugars comprise from about 10-20%. Thus Whelan teaches of a sweetening mixture comprising glucose and polymers including polyols, and high intensity sweeteners combined in the range of 10 to 40%, which falls in applicant's range (10-30%) as recited in claim 1.

Regarding the amount of glucose in the glucose polymer or glucose syrup, the corn syrup as taught by Whelan is has a value of 62 DE, i.e., depending on the method of hydrolysis of starch the glucose (dextrose) content of the corn syrup would vary from 36 to 39% on dry weight basis (as evidenced by Handbook of Industrial chemistry, pages 188-189 table 6.2). Based on the above information the glucose content of the glucose syrup lies within the 30-40% of the corn syrup (glucose polymers) content, as instantly claimed.

Regarding the amount of glucose polymers representing from 10-50% (claim 1) of the sweetening mixture of glucose and polymers as recited by the applicant, Whelan teaches addition of glucose, lactose, sucrose and other nutritive sweeteners from 10-20% of the dessert composition which falls in the recited range of the applicant. The reference also teaches replacing part or whole of the sweetener mixture with low calorie sweeteners such as sorbitol or Xylitol etc., or other high intensity sweeteners, such as, Acesulfame K in the range of 10-20% of the dessert composition. The reference further teaches that a combination of glucose, sucrose etc., with a low or no-calorie sweetener mixture can be used based on the calorie reduction benefit desired. The reference also teaches of varying the composition of the sweetener mixture in order to modify the caloric content of the final product. Thus the reference teaches of sweeteners, where glucose polymers, such as, low calorie sugar alcohols and sucrose and other polysaccharides are in the range of 0 to 100% of the sweetening composition. Thus Whelan reference reads upon the instantly claimed invention. However, the reference does not give any specific proportion of glucose and glucose polymers in the sweetener mixture. Therefore, one of ordinary skill in the art would be motivated to look to the art

for specific proportions of sweeteners. Hilker et al, hereinafter Hilker, teaches of a low fat frozen dessert with an aqueous component and a fat component. The aqueous component comprises water, protein, sweetening agents, stabilizers and flavoring ingredients (Column 2, lines 9-31) as recited by the applicant in claim 1. The sweetening agents taught by Hilker are sucrose and corn syrup solids (Column 3, Lines 53-60, Example I). Sucrose is a polymer of glucose, with two molecules of glucose, i.e., n=2, as recited by the applicant in claim 1. Corn syrup solids are dextrose, i.e., glucose. Thus Hilker teaches the sweetener agents that are used together (i.e., a mixture) which comprise 100% of the sweetener mixture, which is in the recited range of (at least 90%) the applicant. Hilker teaches the frozen confection composition where 10-12% sucrose and 7.5-8% corn syrup solids, i.e., 17.5-20% sweetener (Columns 3 and 4, Examples I and II), i.e., 50% to 60% of the sweetener composition comprising glucose comprises of glucose polymers. Thus the amount of glucose taught by Hilker fall within the instantly claimed ranges for claim 1. From the references above one of ordinary skill in the art would have been able to ascertain that sweetener mixtures with glucose and glucose polymers were known at the time of the invention (Whelan and Hilker). Sweetener mixture with varyious combinations of glucose and polymers were known at the time of the invention (Whelan). Relative proportion of glucose and glucose polymers in the range recited by the applicant was known at the time of the invention (Hilker).

Thus sweetener mixtures with glucose and glucose polymers (corn syrups, corn syrup solids and dextrose and glucose were known at the time of the invention (Whelan and Hilker). Sweetener mixture with varying proportions of glucose and polymers were also known in making of ice cream type frozen confections, at the time of the invention (Whelan). Relative proportion of glucose and glucose polymers in the range recited by the applicant was known at the time of the invention (Whelan and Hilker). It was also known that glucose is less sweet as compared to sucrose and fructose on a weight basis. Further it was known that glucose provides cooling sensation in mouth when consumed. Thus it would have been a matter of routine determination by experimentation for one of ordinary skill in the art at the time of the invention to modify

the sweetener composition based on the desire and availability of various sweeteners. Therefore, one of ordinary skill in the art at the time of the invention would have been motivated to modify Whelan and add sweetener comprising glucose and its polymers in the relative proportion as taught by Hilker, in order to make a frozen dessert with the desired combination of sweetening agents. One would have been further motivated to do so in order to have a hygroscopic sweetener component in the frozen dessert which would enhance the smoothness of the texture of the finished frozen product. One would have been further motivated to do so in order to make the frozen confection with an enhanced cooling effect in the mouth when consumed. Also a set proportion of glucose in the sweetener mixture would be able to provide a frozen dessert product with a certain degree of characteristic glucose sweetness irrespective of the other sweeteners used.

NOTE: The applicant is also referred to the 112 rejections above.

Regarding the stabilizing agents as recited in claim 1, Whelan teaches stabilizing agents including microcrystalline cellulose, locust bean gum, etc., in the frozen dessert composition. Microcrystalline cellulose is a highly purified particulate form of cellulose with a particle size range of 1-150 microns. Microcrystalline cellulose is used as a stabilizer/ emulsifier in foods. Whelan teaches that stabilizing agents produce smoothness in the textural properties of the product and retard ice crystal growth during storage of the product (Column 14, lines 39-55). The reference also teaches of emulsified particle size of 5 microns or less such that the frozen dessert produced has a smooth, creamy and non-gritty mouth feel (Column 7 and 14). The reference further teaches that the fat is emulsified in such a way as to give the final product the smoothness and creaminess of the conventional ice-cream products. The Whelan reference teaches of the stabilizers as recited by the applicants, in the recited range of the applicant. Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention that the stabilizers as taught by Whelan would function in a similar fashion and act as the nucleating agents as in the instantly claimed invention, absent any clear and convincing evidence and arguments to the contrary.

Regarding claim 2, Whelan teaches of stabilizing agent comprising microcrystalline cellulose as recited. The amount of stabilizer included in the frozen dessert is up to 1%, typically from about 0.05% to about 0.5% (Column 14, lines 48-61), which falls within the instantly claimed range.

Regarding claim 3, Whelan teaches that the frozen dessert composition comprises water in the range from about 50 to about 75% (Column 14, lines 30-32), which encompasses applicant's recited range of 40-62%. Regarding the partially frozen water, Whelan teaches water, however, since the reference teaches a frozen dessert composition, the finished frozen product would comprise frozen water as recited.

Regarding claims 4-5, Whelan teaches of stabilizers including carrageenan and xanthan (gums or thickeners), alginate, gelatin, carboxymethylcellulose (CMC), etc., (Column 14, lines 48-55) which are well known in the art as thickeners. The reference also teaches the amount of suitable emulsifiers ranges from about 0.05 to about 2% (Column 14, lines 11-12) and optional ingredients such as egg yolk from about 1 to 2% of the frozen dessert product (Column 14, line 62 to Column 15, line 6). The reference further teaches that suitable emulsifiers are monoglycerides and diglycerides of fatty acids (Column 13, lines 60-68). Thus the reference teaches of emulsifiers and thickeners as recited by the applicant in the instantly claimed range of 0.3 to 2.7%.

Regarding claim 7, Whalen teaches of fructose as part of the sweetener composition (column 12, line 6). Whalen and Hilker are silent regarding the percentage of fructose being less than 1% in the sweetening mixture of the composition. However, glucose (dextrose), fructose and sucrose or sugar were known as sweeteners at the time of the invention. It was also known at the time of the invention that fructose is sweeter than sucrose, which in turn is sweeter than glucose on an equivalent weight basis. Therefore it would have been a matter of routine optimization experimentation for one of ordinary skill in the art at the time the invention was made to substitute one art recognized functional equivalent (i.e. sucrose or glucose or fructose) for another (i.e., a sweetener

with less than 1% fructose) in the frozen confection as disclosed by Whelan, depending on the desired level of sweetness in the frozen product. One would have been further motivated to include less fructose in order to make the frozen confection with less sweetness. One would have been further motivated to reduce the amount of fructose based on which sweeteners were more desirable and available at the time the invention was made. Thus claim 7 is obvious over Whelan in view of Hilker, absent any clear and convincing evidence and arguments to the contrary.

Regarding claim 9, Whelan teaches a fat content from about 2 to about 20% (Column 4, lines 58-60), which encompasses the instantly claimed range of 4-20%.

Regarding claims 10-11, Whelan teaches of suitable plant derived fats including sunflower oil, coconut oil, safflower oil and olive oil (Column 9, lines 1-10) as recited in claims 10 and 11. Sunflower oil, is a plant-based oil with the onset of solidification within the recited range of the applicant. The reference also teaches of milk fat, e.g., butter, (Column 7, lines 38-40) which is a soft solid at room temperature and thus has the onset of solidification at temperatures above 0^0C as recited by the applicant.

Regarding claim 12, Whelan teaches proteins from about 3 to about 15% (Column 11, lines 27-29) as instantly claimed.

Regarding claims 13-14, Whelan teaches suitable proteins including, whole milk, skimmed milk, skimmed milk from which a portion of the lactose has been removed, sweet dairy whey, neutralized acid whey, modified whey, whey protein concentrate etc., (Column 11, lines 35-50). Although Whelan does not specifically teach demineralized whey, however, neutralized acid whey and modified whey as taught by Whelan would include demineralized whey because to produce demineralized whey, whey is modified by ion exchange or electrodialysis to remove the minerals (Wile's Encyclopedia of Food Science and Technology 1999, page 2655).

Regarding claim 15, Whelan teaches of non-dairy based sources of protein, such as, soy protein (Column 11, lines 59-61). Soy is a leguminous plant, thus the reference teaches of leguminous protein source as instantly claimed.

Regarding claim 16, Whelan teaches a frozen dessert product with other components including flavoring substances (Column 13, lines 20-50).

(B) Claim 8 is rejected under 35 U.S.C. 103(a) as being obvious over Whelan et al and Hilker as applied to claims 1-5, 7, 9-16 and 28 above further in view of Cole et a. (US 4,452,824).
Whelan and Hilker have been applied to claims 1-5, 7, 9-16 above.
The references and rejection are incorporated herein and as cited in the office action mailed October 19, 2007.

Regarding claim 8, Whelan does not teach of glycerol in the frozen dessert product. Glycerol is a polyol or polyhydric alcohol that was known for its function for imparting softness to the frozen product. Thus one of ordinary skill in the art at the time of the invention would have been motivated to look to the art for a frozen dessert product with glycerol. Cole et al, hereinafter Cole, teaches a soft frozen dessert comprising low molecular weight polyhydric alcohols such as glycerol at a level of 1% to 5%(Column 2, lines 35-50), which encompasses applicant's instantly claimed range. The reference further teaches that glycerol in the amount taught functions as freezing point depressants to impart increased softness to a frozen product. Thus frozen dessert products with glycerol in the amount recited by the applicant were known at the time of the invention (Cole). It was also known that glycerol helped to depress the freezing point of the frozen product resulting in a softer frozen product (Cole). Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to modify Whelan and add glycerol in the amount taught by Cole in order to depress the freezing point of the product and make a softer and more malleable frozen dessert product.

(C) Claims 1-5 and 8-16 are rejected under 35 U.S.C. 103(a) as being obvious over Morley (US 4,427,701) in view of Cole et al (US. 4,452,824).
The references and rejection are incorporated herein and as cited in the office action mailed October 19, 2007.
Morley teaches a frozen dessert comprising water, proteins, fat, sweetening agents and stabilizing agents. The sweetening agents include fructose, corn syrup, etc at a range from 22 to 30% (Column 6 lines 26-37), which is within applicant's recited range. The stabilizing agents comprise microcrystalline cellulose, locust bean gum, guar gum etc (Column 7 lines 30-33). The particle size of the stabilizing agent, such as microcrystalline cellulose is small enough to act as a nucleating agent because it is well known that microcrystalline particles have very small particle sizes. In addition it would be expected that the water in the frozen dessert is frozen. Morley is silent about the relative amounts of each component in the sweetening mixture. However, blending of sweeteners is well known for their art recognized function. It would have been obvious to one of ordinary skill in the art to expect that the amount of sweetener included is an experimental result variable based on sweetness intensity of the particular sweetener and the sweetness effect desired in the product absent any clear and convincing evidence and/or arguments to the contrary.

Regarding claim 2, Morley discloses microcrystalline cellulose as a stabilizing agent. The amount of stabilizer included in the frozen dessert is typically from about 0.05 to about 1.1%, this range is within applicant's recited range (col 6 line 68, col 7 lines 1-2).

Regarding claim 3, Morley discloses that the amount of water present is from about 50 to 60%, this range is within applicant's recited range (col 5 lines 66-67). It would be expected that the water is partially frozen/frozen because it is utilized in a frozen dessert.
Regarding claims 4-5, Morley teaches suitable emulsifiers from 0.45 to 0.775% (Column 7 lines 39-40) such as mono and di-glycerides. This range is within applicant's recited range. Morley teaches that the stabilizer system employs gelling agent such as gelatin,

carrageenan, sodium alginate etc (col 7 lines 22-26) that are well known in the art as thickeners.

Regarding claim 8, Morley does not teach of glycerol in the frozen dessert product. Glycerol is a polyol or polyhydric alcohol that was known for its function for imparting softness to the frozen product. Thus one of ordinary skill in the art at the time of the invention would have been motivated to look to the art for a frozen dessert product with glycerol. Cole et al, hereinafter Cole, teaches a soft frozen dessert comprising low molecular weight polyhydric alcohols such as glycerol at a level of 1% to 5%(Column 2, lines 35-50), which encompasses applicant's instantly claimed range. The reference further teaches that glycerol in the amount taught functions as freezing point depressants to impart increased softness to a frozen product. Thus frozen dessert products with glycerol in the amount recited by the applicant were known at the time of the invention (Cole). It was also known that glycerol helped to depress the freezing point of the frozen product resulting in a softer frozen product (Cole). Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to modify Morley and add glycerol in the amount taught by Cole in order to depress the freezing point of the product and make a softer and more malleable frozen dessert product.

Regarding claim 9, Morley teaches a fat content from 0 to 5% (col 5 line 15-17). This range is within applicant's recited range.

Regarding claims 10-11, Morley teaches suitable fats including butter fat, sunflower oil, coconut oil, safflower oil, olive oil that are all plant derived (col 5 lines 24-37).

Regarding claim 12, Morley teaches proteins from 4 to 5.5% (col 5 lines 62-63). This range is within applicant's recited range.

Regarding claims 13-14, Morley teaches suitable proteins including, milk, neutralized acid whey, modified whey, whey protein concentrate etc (Column 5 lines 50-65).

Modified whey encompasses demineralized whey because demineralized whey is a known modified whey product.

Regarding claim 15, Morley is silent about the leguminous protein in the frozen confection, however, Cole teaches of non-dairy based sources of protein, such as, soy protein (Column 5, lines 55-65). Soy is a leguminous plant, thus the reference teaches of leguminous protein source as instantly claimed. Thus leguminous sources of protein were known to be added to the frozen confections as taught by Cole. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Morley in view of Cole and add soy based protein as part of the protein component in the frozen dessert composition. One would have been motivated to do so in order to add a relatively inexpensive and readily available source of protein to the frozen confection to attain a desired level of overrun in a cost effective manner.

Regarding claim 16, Morley discloses other components of the frozen dessert product including flavoring substances (Column 6 lines 5-16).

Regarding the newly added limitations to claims 1 and 7 Morley teaches of sweeteners like corn syrup, corn syrup solids and dextrose (glucose) in varying amounts in the sweetening mixture for the frozen confection (Column 6, lines 33-58). Morley teaches that part of sorbitol can be replaced with dextrose (glucose). Morley also teaches of 8.5% 36 DE corn syrup solids (contain about 10% glucose) and 12.5% sorbitol (Column 9, Example 1). In another example Morley also teaches of 7% 36 DE corn syrup solids and 3.8% 24 DE corn syrup solids and 12.2% sorbitol (Column 10, Example 2), thus the reference teaches of varying amounts of dextrose or glucose. Morley also teaches of varying amounts of fructose 3.8-4.3% of the composition (Columns9-10, examples 1 and 2). Morley also teaches of blending of sweeteners in accordance with the properties desired in the finished product, e.g., in fat free compositions, corn syrup with low DE is added in addition to the regular corn syrup (Column 6, lines 38-44). Thus altering the sweetener amount and also the kind of sweetener based on the characteristics desired

in the finished product was well known in the art at the time of the invention. Therefore, it would have been a matter of routine experimentation and determination for one of ordinary skill in the art to modify Morley and alter the sweetener mixture by increasing the amount of (glucose) dextrose to 30-40% of the sweetener composition and also decreasing the amount of fructose in the sweetener to less than 1% of the sweetener mixture in order to make the finished product with the desired flavor, texture or intensity of sweetness. One of ordinary skill would have been motivated to do so in order to make the finished product with desirable taste and texture without excessive sweetness (e.g., of fructose and some non-nutritive sweeteners) or an undesirable aftertaste. Therefore, modifying the relative amounts of sweeteners in the frozen confection composition does not lend patentable distinction to the claims, absent any clear and convincing evidence and/or arguments to the contrary.

Response to Arguments

Applicant's arguments filed October 30, 2007, regarding the rejection of claims 1-5, 7-16 have been fully considered but have not been found persuasive.
Regarding the claim rejections under 35 USC 112, applicant is referred to the office action above.

I) In response to applicant's argument that the references fail to show certain features of applicant's invention, it is noted that the features upon which applicant relies (i.e., the "spoonable character" and "capacity to be distributed by the nozzle of a pressurized container" as stated in Remarks, page10) are not recited in the rejected claim(s).

Similarly applicant's statement "Therefore, it becomes possible to use whole milk as a source of proteins, for example, and no longer only skimmed milk, as was the case in previously known frozen desserts. The fat in the milk can now partially replace the fat having an onset of solidification temperature of less than 0 °C." (Remarks, page 12) has not been recited in the rejected claims.

Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993).

II) In response to applicant's arguments against the references individually (Remarks, pages 12-15), one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986). In the instant case Whelan in rejection (A) and Morley and Cole in rejection (C) teach of a frozen confection composition with sweetener, water, protein, fat, emulsifier, thickeners and stabilizing agents in the instantly claimed ranges. The references also teach of glucose polymers and glucose (dextrose), and glucose syrup as part of the sweetener composition, where the amount of glucose falls in the instantly claimed range.

Regarding applicant's argument that Hilker does not teach of glucose or glucose polymers (Remarks, page 12), applicant is referred to the office action above and also to Hilker Columns 3 and 4 where Hilker teaches of corn syrup solids, i.e., dextrose or glucose in the amounts ranging from 7.5-8% of the frozen confection which falls in the instantly claimed range of 6-30% for the total sweetener and 1.8 to 12% for glucose as discussed in the office action above. Thus the reference also teaches that higher proportion of glucose was known to be used as sweetener in the art of making frozen confections. Thus the references teach of frozen confections with glucose content in the instantly claimed range.

Regarding fructose Whelan teaches of sweetener comprising fructose, however Whelan does not teach of fructose comprising less than 1% of the sweetener as instantly claimed, however, fructose and glucose have been known in the art for their respective sweetness characteristics, therefore to substitute one functional equivalent for another would have been a matter of routine determination for one of ordinary skill at the time of the invention. Therefore using more glucose and less fructose in a frozen confection

composition does not impart patentable distinction to the claims absent any clear and convincing evidence and/or arguments to the contrary.

III) Regarding applicant's response that the references do not teach glucose representing 30-40% of the glucose polymers in the sweetening agent mixture (Remarks, page 13), the applicant is referred to the rejections under 35 USC 112 and 35 USC 103(a) above.

IV) In response to applicant's argument that the Whelan reference teaches of more glucose than the range recited in claim 1 (Remarks, page 13), applicant is referred to the claim where at least 90% of the sweetening mixture comprises of glucose and glucose polymers and out of that 10-50 are glucose polymers making at least 40-80% glucose. Further claim states that 30-40% of the glucose polymer content is glucose, which further adds 3-20% glucose, thus increasing the glucose content to at least 43 to 100% of the sweetening composition as recited. Thus applicant's calculation differs from the recitation of claim 1 in the total glucose content in the sweetening composition and the art of record is still applicable, absent any clear and convincing evidence and or arguments to the contrary.

V) Applicant's argument that "recited ranges as claimed in the independent claim 1 achieve unexpected results relative to the prior art range" (Remarks, page 9 and page 11) has not been found persuasive because the prior art references (Whelan and Hilker) include glucose amounts that fall within the instantly claimed range of claim 1. Thus if the amount of total sweetener and relative amount of glucose in the frozen confection in the prior art is in the recited range, then the sweetening and texturizing effects of glucose in the prior art would also be similar to the ones in the instantly claimed invention. Therefore, one of ordinary skill would not only have motivation to add glucose in the instantly claimed range but also have a reasonable expectation of success of achieving the textural and sweetening characteristics similar to the instantly claimed invention, absent any clear and convincing evidence and or arguments to the contrary.

VI) Applicant's arguments regarding Morley have also been considered and responded to in the office action above.

Therefore, applicant's arguments have been considered and have not been found persuasive and the claims 1-5, 7-16 remain rejected for the reasons of record.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jyoti Chawla whose telephone number is (571) 272-8212. The examiner can normally be reached on 8:00 am to 4:30 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Keith Hendricks can be reached on (571) 272-1401. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Jyoti Chawla
Examiner
Art Unit 1794

KEITH D. HENDRICKS
SUPERVISORY PATENT EXAMINER

EXHIBIT B

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/802,865	03/18/2004	Philippe Jerome Didier Riviere	88265-7344	5444

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EXAMINER	
CHAWLA, JYOTI	
ART UNIT	PAPER NUMBER
1794	

NOTIFICATION DATE	DELIVERY MODE
08/07/2008	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

PATENTS@BELLBOYD.COM

Office Action Summary	Application No.	Applicant(s)	
	10/802,865	RIVIERE ET AL.	
	Examiner	Art Unit	
	JYOTI CHAWLA	1794	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *09 May 2008*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-5 and 7-27* is/are pending in the application.

4a) Of the above claim(s) *17-27* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-5 and 7-16* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Applicant's amendment filed May 9, 2008 has been entered. Claims 1 and 7 have been amended, and claim 6 has been cancelled, claims 17-27 remain withdrawn from consideration pertaining to a non-elected invention. Claims 1-5, 7-16 remain pending and are examined in the application.

Claim Rejections - 35 USC § 112

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

Rejection of claims 1-5, 7-16 under 35 USC 112 second paragraph, as being indefinite for recitation of sweetening agent mixture composition have been withdrawn based on applicant's amendments dated 5/9/2008.

Rejection of claims 1-5, 7-16 for being indefinite for the recitation of "freezing temperature range" without specifying the range has been withdrawn based on applicant's arguments regarding the "freezing temperature" (Remarks, 5/9/08, page 9).

Rejection of claims 1-5, 7-16 under 35 USC 112 second paragraph, as being indefinite for recitation of relative terms "malleable" and "extrudable" are maintained for reasons of record. Claim 1, as amended is still unclear for the recitation of relative terms "malleable" and "extrudable", as stated in the previous office actions dated April 5, 2007 and October 19, 2007, it is not clear as to what standard of malleability or extrusion is employed to establish if a frozen dessert product is adequately malleable or extrudable according to the claim as recited. For the purposes of prior art comparison a frozen dessert composition that claims to be extrudable or soft serve or comprising microcrystalline cellulose (nucleating agent, as disclosed) would be regarded as having the property of nucleating water during the freezing of the frozen dessert composition so that the composition, independent of any incorporation of gas, is malleable and extrudable at freezing temperatures, as recited in the instantly claimed invention.

Claim Rejections - 35 USC § 103

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action

Note: The term "oligosaccharide", as referred in the office action below, has been interpreted as saccharide compounds with "a few" repeating units, wherein the number of repeating units generally varies from 3-10. This interpretation is based on the definition of prefix "oligo" obtained from the IUPAC Gold site which sources the PAC, 1995, 67, 1307, page 1353 of the Glossary of class names of organic compounds and reactivity intermediate Recommendations 1995. A copy of the reference has been included with the office action for applicant's review.

(A) Claim 1-5, 7, 9-16 are rejected under 35 U.S.C. 103(a) as being obvious over Whelan et al (US 5,084,295) in view of Hilker et al, hereinafter Hilker (US 3128193).

The references and rejection are incorporated herein and as cited in the office action mailed January 11, 2008.

Regarding claim 1, Whelan et al, hereinafter Whelan, teaches a frozen dessert composition comprising of water, proteins, and fat, sweetening agents and stabilizing agents (Abstract and Column 6, lines 1-8, lines 31-38). Regarding the frozen water, Whelan teaches water, however, since the reference teaches a frozen dessert composition, the finished frozen product would comprise frozen water as recited.

Regarding the proportion of the sweetening mixture to be 6-30% of the frozen confection, as recited in claim 1, Whelan's sweetening composition comprises from about 10 to about 20% of the product (Column 12, lines 5-16) and the reduced calorie sugars comprise from about 10-20%. Thus Whelan teaches of a sweetening mixture comprising glucose and glucose polymers including polyols, and high intensity

sweeteners combined in the range of 10 to 40%, which falls in applicant's range (6-30%) as recited in claim 1.

The sweetening agents as taught by Whelan include glucose, fructose, maltose (glucose polymer with two glucose units) corn syrup, maple syrup, honey, brown sugar, refiner's syrup (i.e., liquid sugar or sucrose) etc. Whelan further teaches addition of reduced calorie or no calorie sweeteners that replace the sweetening composition partially or completely (Column 12, lines5-16). It is noted that corn syrup comprises mainly of glucose, maltose (two molecules of glucose), maltotriose (three molecules of glucose) and oligosaccharides of glucose with degree of polymerization greater than 3, as evidenced by Handbook of Industrial chemistry, pages 188-189 table 6.2 (Already part of record). Thus, the sweeteners taught by Whelan include glucose as discussed above and glucose polymers including maltose (Column 12, line 6) and corn syrup which primarily contains dextrose/glucose, maltose and maltotriose, (both glucose polymers with n=2 and n=3 respectively) and polyols and high intensity sweeteners (Columns 8, 25-53 and Column 12, lines 5-68).

Regarding the amount of glucose polymers representing from 10-50% (claim 1) of the sweetening agent mixture as recited by the applicant, Whelan teaches corn syrup having the value of 62 DE, i.e., depending on the method of hydrolysis of starch the glucose (dextrose) content of the corn syrup would vary from 36 to 39% on dry weight basis and the rest 61-64% of the sweetener in corn syrup is glucose polymers, like maltose, maltotriose and higher oligosaccharides of glucose (as evidenced by Handbook of Industrial chemistry, pages 188-189 table 6.2, already of record). As evidenced by the information from the Handbook of Industrial chemistry, the glucose polymer content of the glucose/corn syrup as taught by Whelan lies within 61-64% of the corn syrup composition and of the corn syrup (glucose polymers) content. Further in Example 1, Whelan teaches of nutritive sweetener comprising dry sucrose 1.87% + 0.6%, Liquid sugar 14.93% and 62 DE Corn Syrup 2.98% in the total frozen confection composition of 200%. The total of dry sucrose, liquid sugar and corn syrup amounts to about 10% by weight and the glucose polymers only in corn syrup amount to 2/3 of the corn syrup, i.e., glucose polymers comprise about 10% of the total amount of sweetener

comprising dry sucrose, liquid sugar and corn syrup, which falls in applicant's recited range for glucose polymers of 10-50%. Further, Whelan also teaches of varying the composition of the sweetener mixture in order to modify the caloric content of the final product. Thus, Whalen teaches of sweeteners, where glucose polymers, such as, maltose, maltotriose and other oligosaccharides of glucose present in corn syrups (Column 12) comprise 10-50% of the weight of sweetening agent composition. Thus Whelan reference reads upon the instantly claimed invention.

Regarding the amount of glucose and glucose polymers comprising at least 90% by weight of the sweetening agent mixture, as recited in the newly amended claim 1 and as clarified by the applicant's remarks filed on may 9, 2008 (Page 9, lines 5-8), where the applicant states that the sweetening composition comprises at least 90% by weight of glucose and glucose polymers and other components, which does not specifically state that the glucose and glucose polymers are the only two components that make up at least 90% of the sweetening agent mixture. Whalen teaches of glucose, sucrose, invert sugar, maltose, corn syrup and high maltose corn syrup, as sources of carbohydrate sweeteners, which comprise of glucose and glucose polymers (Column 12, lines 5-16). Whalen teaches that the amount of nutritive sweeteners is selected to provide the desired sweetness intensity in the frozen dessert product (Column 12, lines 11-13). Whalen also teaches that the amount of nutritive sweeteners can be varied based on the calorie reduction benefit desired (Column 12, lines 17-18). Thus, Whalen teaches of sweetener composition comprising glucose and glucose polymers, such as, maltose, maltotriose and other oligosaccharides of glucose present in corn syrups (Column 12 and) as well as low calorie sugar alcohols and other polysaccharides comprise 0-100% of the sweetening agent composition. Thus Whelan reference reads upon the instantly claimed invention. The blending of sweeteners was well known in the art at the time of the invention for their art recognized function. Hilker has been referenced to clarify that it was known to include a sweetening mixture comprising glucose and glucose polymers in the recited range of the applicant. Hilker teaches of a low fat frozen dessert with an aqueous component and a fat component. The aqueous

component comprises water, protein, sweetening agents, stabilizers and flavoring ingredients (Column 2, lines 9-31) as recited by the applicant in claim 1. The sweetening agents taught by Hilker are sucrose and corn syrup solids (Column 3, Lines 53-60, Example I). Sucrose is a polymer comprising glucose. Corn syrup solids are hydrolysis products of corn starch where complete hydrolysis of corn starch to dextrose has not occurred and as a result corn syrup solids include low dextrose, i.e., low amount of glucose, but high amounts of dextrins, maltodextrins and other glucose oligomers and polymers. Thus, Hilker teaches the sweetening agent wherein glucose and polymers of glucose are used together as a mixture, and the mixture comprises up to 100% of the sweetener mixture, which includes applicant's recited range (at least 90% of sweetener mixture comprising glucose polymers and glucose).

Thus, blending of sweeteners was well known in the art at the time of the invention, for their art recognized function. Amount of sweetener mixture in a f4rozen confection is selected based on the desired sweetness in ice cream type frozen confections (Whelan, Column 12). Relative proportion of glucose and glucose polymers in the range recited by the applicant was known at the time of the invention (Whelan and Hilker). Therefore, it would have been a matter of routine determination by experimentation for one of ordinary skill in the art at the time of the invention to modify the sweetener composition at least based on the availability of sweeteners and the sweetness intensity and specific sweetness effect desired in the product absent any clear and convincing evidence and/or arguments to the contrary.

Further, attention is invited to *In re Levin*, 84 USPQ 232 and the cases cited therein, which are considered in point in fact situation of the instant case. At page 234, the Court stated as follows: This court has taken the position that new recipes or formulas for cooking food which involve the addition or elimination of common ingredients, or for treating them in ways which differ from the former practice, do not amount to invention, merely because it is not disclosed that, in the constantly developing art of preparing food, no one else ever did the particular thing upon which the applicant asserts his right to a patent. In all such cases, there is nothing patentable unless the applicant by a proper showing further establishes a coaction or cooperative relationship between the

selected ingredients, which produces a new, unexpected and useful function. In re Benjamin D. White, 17 C.C.P.A. (Patents) 956, 39 F.2d 974, 5 USPQ 267; In re Mason et al., 33 C.C.P.A. (Patents) 1144, 156 F.2d 189, 70 USPQ 221.

Regarding the stabilizing agents as recited in claim 1, Whelan teaches stabilizing agents including microcrystalline cellulose, locust bean gum, etc., in the frozen dessert composition, which includes applicant's recited stabilizing agents. Whelan teaches that stabilizing agents produce smoothness in the textural properties of the product and retard ice crystal growth during storage of the product (Column 14, lines 39-55). Whelan also teaches of emulsified particle size of 5 microns or less such that the frozen dessert produced has a smooth, creamy and non-gritty mouth feel (Column 7 and 14). Whelan further teaches that the fat is emulsified in such a way as to give the final product the softness, smoothness and creaminess of the conventional ice-cream products, i.e., the product is malleable and extrudable. Whelan reference also teaches of the stabilizers, such as microcrystalline cellulose, as recited by the applicant, in the recited range of the applicant. The particle size of the stabilizing agent, such as microcrystalline cellulose is small enough to act as a nucleating agent. Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention that stabilizer, such as microcrystalline cellulose, upon addition to a frozen confection composition of Whalen, will function in a similar manner and act as the nucleating agent for water during the freezing of the frozen dessert composition so that the composition, independent of any incorporation of gas, is malleable and extrudable at freezing temperatures, as the microcrystalline cellulose in the instantly claimed invention, absent any clear and convincing evidence and arguments to the contrary.

Further, regarding the malleability characteristic of the dessert, applicant remarks dated 5/9/2008, page 10, lines 2-5, which refer to the specification (Page 8, lines 19-22) where it is stated that "sufficient malleability of the dessert is achieved when the protein level in the composition is between 3-18% relative to the total weight of the composition of the dessert". Whelan teaches of 3-15% milk solids other than fat, which include protein and milk sugar. Thus protein level as taught by Whalen falls within the

applicant's range of protein to achieve sufficient malleability. Therefore, Whelan teaches of frozen dessert composition with sufficient malleability as defined by the applicant.

Regarding the amendment to claim 7, Whalen teaches of glucose, sucrose, invert sugar, corn syrup (i.e., glucose syrup), maltose, high maltose corn syrup and fructose as possible components of the sweetener composition (column 12, lines 5-16). Whalen and Hilker are silent regarding the percentage of fructose being less than 1% in the glucose syrup of the composition. However, glucose syrup or corn syrup, having fructose content less than 1% were known and available at the time of the invention, as evidenced by Handbook of Industrial chemistry, pages 188-189 table 6.2 (Already part of record). It was also known at the time of the invention that fructose is sweeter than sucrose, which in turn is sweeter than glucose on an equivalent weight basis. Therefore, it would have been a matter of routine optimization experimentation for one of ordinary skill in the art at the time the invention was made to substitute one art recognized functional equivalent (i.e., fructose or high fructose corn syrup or sucrose) as taught by Whalen for another (i.e., maltose, glucose, high maltose corn syrup, corn syrup etc. sweeteners comprising less than 1% fructose) as also taught by Whelan, in the frozen confection. One would have been motivated to choose the specific sweeteners and modify the sweetener component at least based on the availability, cost and the desired level of sweetness in the frozen product. Thus claim 7, is obvious over Whelan in view of Hilker, absent any clear and convincing evidence and arguments to the contrary.

Regarding claims 2-5, 9-16 refer to the rejection made in the office action dated January 11, 2008.

(B) Claim 8 is rejected under 35 U.S.C. 103(a) as being obvious over Whelan et al and Hilker as applied to claims 1-5, 7, 9-16 and 28 above further in view of Cole et a. (US 4,452,824).
Whelan and Hilker have been applied to amended claims 1 and 7 above

The references and rejection are incorporated herein and as cited in the office action mailed January 11, 2008.

(C) Claims 1-5 and 8-16 are rejected under 35 U.S.C. 103(a) as being obvious over Morley (US 4,427,701) in view of Cole et al (US. 4,452,824).
The references and rejection are incorporated herein and as cited in the office action mailed January 11, 2008.

Regarding amended claim 1, Morley teaches a frozen dessert comprising water, proteins, fat, sweetening agents and stabilizing agents. Morley teaches of a frozen dessert and it would be expected that the water in the frozen dessert is frozen. The sweetening agents include fructose, corn syrup, etc at a range from 22 to 30% (Column 6 lines 26-37), which is within applicant's recited range.
Regarding the newly added limitation that glucose polymers represent 10-50% of the sweetening mixture composition in the frozen dessert, Morley teaches of sweeteners like corn syrup (i.e., glucose syrup), corn syrup solids and dextrose (i.e., glucose) in varying amounts in the sweetening mixture for the frozen confection (Column 6, lines 33-58). It is noted that corn syrup and corn syrup solids contain maltose, maltotriose and maltodextrin, and other oligosaccharides, which are glucose polymers (as evidenced by Handbook of Industrial chemistry, pages 188-189 table 6.2 {Already part of record}). Morley also teaches of 8.5% 36 DE corn syrup solids (which contain about 10% glucose and rest 90% glucose polymers) in total sweetener composition of 24.8% by weight (Column 9, Example 1). According to example 1 of Morley
Glucose polymers are 7.65% (90% of 8.5%)
Total sweetener content of 24.8 %,
i.e., glucose polymers proportion is (7.65/24.8)X 100= 30.84%
Thus the amount of glucose polymers in the sweetener mixture composition as taught by Morley is about 30%, which falls within applicant's recited range for glucose polymers 10-50%.

Regarding the amount of glucose and glucose polymers comprising at least 90% by weight of the sweetening agent mixture, as recited in the newly amended claim 1 and as clarified by the applicant's remarks filed on may 9, 2008 (Page 9, lines 5-8), where the applicant states that the sweetening composition comprises at least 90% by weight of glucose and glucose polymers and other components, which does not specifically state that the glucose and glucose polymers are the only two components that make up at least 90% of the sweetening agent mixture. Morley teaches of employing a combination of saccharides that causes freezing point depression, sweetness, body, texture and flavor (Column 6, lines 17-20). Morley teaches that the sweeteners can be corn syrup (i.e., glucose syrup) preferably 36 DE and 24 DE corn syrups, dextrose (i.e., glucose), fructose, sorbitol , sucrose, mannitol, which are important in providing a soft serve frozen confection (Column 6, lines 33-47). Morley also teaches that sweetening agent component can be modified based on the subjective properties desired in the final product, i.e., blending of sweeteners in accordance with the properties desired in the finished product such as, in fat free compositions, Morley teaches of adding low DE corn syrup in addition to the regular corn syrup (Column 6, lines 38-45). Morley is silent about glucose polymers and glucose comprising at least 90% of the sweetening agent mixture. It would have been obvious to one of ordinary skill in the art to expect that the amount of sweetener included is an experimental result variable based on sweetness intensity of the particular sweetener and the sweetness effect desired in the product. Cole teaches of soft frozen dessert formulation wherein some of the saccharide or sweetener formulations comprise entirely of corn syrup solids and dextrose, i.e., 100% of the sweetener composition comprises glucose and glucose polymers (Columns 7-8, Tables 1-3, composition run 89, 91-92), as is instantly claimed. Cole further teaches that the compositions have adequate sweetness, softness and extrudability, as is instantly claimed (Columns 7-9). Thus, sweetener compositions comprising at least 90% of glucose and glucose polymers were known in the art of making frozen dessert at the time of the invention (Cole). It was also known to vary the sweetener composition for a frozen dessert based on the taste, texture, freezing point depression and other subjective properties desired in the final product (Morley and Cole). Further it was also

known that the sweetener composition containing corn syrup solids (glucose and glucose polymers) with or without dextrose (glucose) in a frozen dessert composition can yield a soft, creamy , adequately sweet and extrudable frozen dessert composition, which can be stored in home freezer (Cole, columns 7-9), which is also the intent of the applicant. Therefore, it would have been obvious to one of ordinary skill in the art to modify the sweetener composition of Morley based on the teaching from Cole and primarily include a combination of glucose and glucose polymers, which would provide desired sweetness, body, texture, flavor to produce a soft serve or malleable product at freezer temperature, while also providing the desired freezing point depression in the frozen dessert, such that the dessert can be extruded. One would have been further motivated to modify the sweetener composition in order to make a frozen composition that has the storage stability in home freezer for several weeks without the development of undesirable iciness (Cole, Column 9lines 1-5).

The stabilizing agents comprise microcrystalline cellulose, locust bean gum, guar gum etc (Column 7 lines 30-33) and amount of stabilizer as taught by Morley about 0.05 to about 1.1%, this range is within applicant's recited range (Column 6 line 68, Column 7 lines 1-2). Thus, Morley teaches of the stabilizers as recited by the applicant, in the recited range of the applicant. The particle size of the stabilizing agent, such as microcrystalline cellulose is small enough to act as a nucleating agent. Morley also teaches that the frozen confection upon storage in grocery store or hone freezer, retains soft serve characteristic when dispensed directly from the package, i.e., malleable, as instantly claimed. Further, regarding the malleability characteristic of the dessert, applicant remarks dated 5/9/2008, page 10, lines 2-5, which refer to the specification (Page 8, lines 19-22) where it is stated that "sufficient malleability of the dessert is achieved when the protein level in the composition is between 3-18% relative to the total weight of the composition of the dessert". Morley teaches of protein level ranging from 4-5.5%, which falls within the applicant's range of protein to achieve sufficient malleability. Therefore, Morley teaches of frozen dessert composition with sufficient malleability as defined by the applicant. Morley also teaches that the frozen confection

in a package can also be manipulated to extrude the soft serve frozen confection under hand pressure, i.e., extrudable (Column 4, lines 14-28), as instantly claimed. Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention that stabilizer, such as microcrystalline cellulose, upon addition to a frozen confection composition of Morley, will function in a similar manner and act as the nucleating agent for water during the freezing of the frozen dessert composition such that Morley's composition, independent of any incorporation of gas, is malleable and extrudable at freezing temperatures, as the microcrystalline cellulose in the instantly claimed invention, absent any clear and convincing evidence and arguments to the contrary.

Regarding newly amended claim 7, Morley teaches of corn syrup or glucose syrup with 36 DE (Dextrose Equivalent) with or without further addition of 26 DE as part of the sweetener mixture (column 6, lines 37-39). Corn syrups contain, dextrose (glucose), maltose (glucose polymer with 2 glucose molecules), maltotriose (glucose polymer with 3 glucose molecules) and other glucose oligosaccharides or polymers of glucose (as evidenced by Wiles Encyclopedia of Food Science and Technology, page 2242 {Already part of record}). The amount of fructose in an untreated corn syrup which has not been treated with an enzyme to convert the glucose into fructose is negligible. Fructose containing corn syrups are generally known as high fructose corn syrup or fructose corn syrup. Morley teaches of corn syrup (i.e., glucose syrup) as one of the main sweetener components and corn syrup contains negligible amount of fructose. Therefore, Morley teaches of corn or glucose syrup as recited in the amended claim 7.

Regarding claims 2-5 and 8-16, applicant is referred to the office action dated January 11, 2008.

Response to Arguments

Applicant's arguments filed May 9, 2008, regarding the rejection of claims 1-5, 7-16 have been fully considered but have not been found persuasive.

Regarding the claim rejections under 35 USC 112, applicant is referred to the office action above.

I) In response to applicant's argument that "if the percentage of glucose increases in the composition, the frozen dessert obtained is more malleable" (Remarks, page 12, lines 8-10).

Similarly applicant's remarks that "Applicant's have surprisingly found that it is possible to reduce the proportion of fat in a frozen dessert without limiting the malleability of the dessert at freezing temperature...by using the sweetening agent mixture of glucose polymers and glucose at the levels as claimed" ; "the presence, in the proportions as claimed , of these glucose polymers can make it possible to avoid or reduce the greasy taste of frozen dessert without reducing the dessert's spoonable character and its capacity to be distributed by the nozzle of a pressurized container at the freezing temperatures"; and ""the sweetening agents mixture can comprise from 10-50% of glucose polymers, it is possible to not only compensate for the reduction of the quantity of fat to be used in the composition of frozen dessert according to the present invention, but also to allow a modification of the nature of the fat" (Remarks, page 12, lines 11-24)

In response to applicant's argument that the references fail to show certain features of applicant's invention, it is noted that the features upon which applicant relies (i.e., the "reduce the proportion of fat in a frozen dessert without limiting the malleability of the dessert at freezing temperature", "glucose polymers can make it possible to avoid or reduce the greasy taste of frozen dessert without reducing the dessert's spoonable character", "dessert's spoonable character", "capacity to be distributed by the nozzle of a pressurized container", "reduction of the quantity of fat" and "allow a modification of the nature of the fat" (Remarks, pages 10 and 12) are not recited in the rejected claim(s).

Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993).

II) In response to applicant's argument that "recited ranges as claimed in independent claim 1, achieve unexpected results relative to the prior art range and are not disclosed in the prior art references" (Remarks, page 10, lines 25-29), the applicant is referred to the rejection of claim 1 above where Whalen in view of Hilker teaches the claimed sweetener ranges. Similarly, the applicant is referred to rejection of claim 1 above, where Morley in view of Cole teaches the recited sweetener composition. Further it is noted that to include an increased amount of glucose and glucose polymers in the sweetener mixture composition as disclosed by Hilker in one instance and Cole in the other would be a matter of judicious selection of a known component already disclosed in the composition. One would have been motivated to increase the amount of a given component to enhance the effect of its desirable properties without adversely affecting the flavor or other properties of the composition. This would not have involved inventive step as optimal ranges for a recognized result effective variable, such as glucose, maltose, maltotriose or other glucose oligomers or polymers as sweetening agents, may be identified through routine experimentation (MPEP 2144.05). To increase such a variable and obtain increased depression of freezing point, increased creaminess or smoothness of texture is nothing more than the achievement of expected results.

III) In response to applicant's arguments against the references individually (Remarks, pages 12-15), one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986). In the instant case Whelan in view of Hilker in rejection (A) and Morley and Cole in rejection (C) teach of a frozen confection composition with sweetener, water, protein, fat, emulsifier, thickeners and stabilizing agents in the instantly claimed ranges. The references also teach of glucose polymers and glucose (dextrose), and glucose syrup as part of the sweetener composition, where the amount of glucose polymers and the total sweetening mixture component falls in the instantly

claimed ranges (See rejection above and in previous office action dated January 11, 2008).

Regarding applicant's argument that Hilker does not teach of glucose or glucose polymers represent 10-50% of the weight of sweetening agent mixture (Remarks, pages 13 and 14), applicant is referred to the office action above where Whalen and Morley teach glucose polymers in the recited amount. Applicant is also referred to Hilker Columns 3 and 4 where Hilker teaches of corn syrup solids, i.e., dextrose or glucose in the amounts ranging from 7.5-8% of the frozen confection which falls in the instantly claimed range of 6-30% for the total sweetener and 1.8 to 12% for glucose as discussed in the office action above. Thus the reference also teaches that higher proportion of glucose was known to be used as sweetener in the art of making frozen confections. Thus the references teach of frozen confections with glucose content in the instantly claimed range. In addition applicant is also referred to Cole, where the Tables 1-3 in Columns 7-8 show various saccharide or sweetener compositions, where 89, 91-92 comprise of corn syrup solids optionally with added dextrose as sweetener, i.e., the entire sweetener composition comprises of glucose and glucose oligomers, such as maltose, maltotriose and higher oligosaccharides.

Regarding the fructose content of glucose syrup as recited in the amended claim 7, applicant is referred to the rejection of claim 7 above.

IV) Applicant's argument that "recited ranges glucose polymers representing from 10-50% of the weight of the sweetening agent mixture as claimed in the independent claim 1 achieve unexpected results relative to the prior art range" (Remarks, page 14, lines 25-27)) has not been found persuasive because the prior art references (Whelan and Morley) include glucose polymers in the instantly claimed range of claim 1. Thus if the amount of total sweetener and relative amount of glucose polymer in the frozen confection in the prior art is in the recited range, then the sweetening and texturizing effects of glucose polymers in the prior art would also be similar to the ones in the instantly claimed invention. Therefore, not only will one of ordinary skill at the time of the invention have known to add total sweetener and glucose polymers in the instantly

claimed range in the frozen dessert composition, but one would also have a reasonable expectation that the textural and sweetening characteristics that result from the presence of glucose polymers in the instantly claimed range will also be present in the frozen dessert composition of Whalen and Morley, similar to the textural and sweetening characteristics as recited in the instantly claimed invention, absent any clear and convincing evidence and or arguments to the contrary. Thus applicant's assertion of unexpected results has not been found persuasive.

Applicant's arguments and remarks presented on May 9, 2008 have been fully considered and have not been found persuasive and the claims 1-5, 7-16 remain rejected for the reasons of record.

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to JYOTI CHAWLA whose telephone number is (571)272-8212. The examiner can normally be reached on 9:00 am to 5:30 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Keith Hendricks can be reached on (571) 272-1401. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Jyoti Chawla
Examiner
Art Unit 1794

/KEITH D. HENDRICKS/
Supervisory Patent Examiner, Art Unit 1794

Notice of References Cited	Application/Control No. 10/802,865	Applicant(s)/Patent Under Reexamination RIVIERE ET AL.	
	Examiner JYOTI CHAWLA	Art Unit 1794	Page 1 of 1

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*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
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NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	IUPAC Compendium of Chemical Terminology, Electronic version, http://goldbook.iupac.org/O04282.html, page 1. Transformed and rewritten from PDF version (entry http://www.iupac.org/goldbook/O04282.pdf) by: Miloslav Nic, Jiri Jirat, Bedrich Kosata, ICT Prague, Czech Republic
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*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

EXHIBIT C

US005084295A

United States Patent [19]

Whelan et al.

[11] Patent Number: 5,084,295

[45] Date of Patent: Jan. 28, 1992

[54] PROCESS FOR MAKING LOW CALORIE FAT-CONTAINING FROZEN DESSERT PRODUCTS HAVING SMOOTH, CREAMY, NONGRITTY MOUTHFEEL

[75] Inventors: Richard H. Whelan, Medfield; Marvin J. Rudolph, Sharon; Vanik D. Petrossian, Waban, all of Mass.

[73] Assignee: The Procter & Gamble Company, Cincinnati, Ohio

[21] Appl. No.: 474,189

[22] Filed: Feb. 2, 1990

[51] Int. Cl.[5] A23G 9/04

[52] U.S. Cl. 426/565; 426/567; 426/602; 426/611; 426/613; 426/804

[58] Field of Search 426/602, 603, 604, 611, 426/613, 804, 565, 567

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Primary Examiner—Donald E. Czaja
Assistant Examiner—Anthony Weier
Attorney, Agent, or Firm—Eric W. Guttag; Ron L. Hemingway; Richard C. Witte

[57] ABSTRACT

Low calorie frozen desserts, in particular ice cream-like products, having a smooth, creamy, nongritty mouthfeel are disclosed. These frozen desserts contain fat comprising from about 30 to 100% of certain edible, wholly or partially nondigestible intermediate melting polyol polyesters, milk solids other than fat, sweetener, oil-in-water emulsifier, a flavoring substance, and water. The fat is substantially homogeneously dispersed in the aqueous phase as emulsified fat particles having an average particle size of about 5 microns or less. These frozen desserts are obtained by a process which initially involves the formation of a preemulsion by homogenizing a mixture which consists essentially of these intermediate melting polyol polyesters and only a portion of the other dessert ingredients. This preemulsion is then combined with the remaining dessert ingredients, homogenized, pasteurized, and at least partially frozen to provide the frozen desserts.

15 Claims, No Drawings

PROCESS FOR MAKING LOW CALORIE FAT-CONTAINING FROZEN DESSERT PRODUCTS HAVING SMOOTH, CREAMY, NONGRITTY MOUTHFEEL

TECHNICAL FIELD

This application relates to low calorie fat-containing frozen dessert products that have a relatively smooth, creamy, nongritty mouthfeel. This application further relates to a process for preparing such frozen desserts.

Ice cream and other frozen dessert products (e.g., frozen custards, ice milk, mellorines) are marketed internationally to many consumers. Ice cream is particularly recognized for its smooth, creamy texture which is achieved by a delicate balance of formulated ingredients and processing steps to provide the desired coldness, meltdown, mouthfeel, and taste characteristics normally expected of such high-quality frozen dessert products. A primary component of ice cream products are the dairy-based ingredients. In earlier times, milk and cream provided the basic ingredients, i.e. milk protein, milk sugar, milkfat (butterfat), emulsifiers and stabilizers, necessary for making ice cream products. In current commercial operations, this ice cream formulation can comprise added nonfat milk solids, milkfat, sugar and water to replace in whole or in part the milk/cream, as well as other nondairy ingredients such as egg yolks, emulsifiers and stabilizers.

In a typical commercial ice cream operation, a mixture of cream, milk, sugar, added water (optional), added nonfat milk solids (optional), emulsifiers (optional), and stabilizers (optional) is formed, pasteurized and then passed through either a single, or double-stage, homogenizer. During homogenization, the globules of milkfat that are present in the cream and milk are broken up and dispersed as relatively small fat droplets or particles (0.1 to 2 microns in size) in a continuous aqueous phase, i.e. an oil-in-water emulsion is formed. During the freezing step, the homogenized mixture is typically subjected to agitation, whipping and aeration to incorporate the desired amount of air (referred to as "overrun"), and to avoid the formation of large ice crystals in, and/or a stratification of, the product. Flavoring substances (e.g., vanilla) are typically added to this homogenized mixture before it is fully hardened to provide a firm ice cream product. Because of the relatively small particle size of the dispersed milkfat due to homogenization, as well as the small particle size of the dispersed ice crystals and air cells formed during freezing, conventional firm ice cream products provide a relatively smooth, creamy mouthfeel.

By definition, ice cream contains at least 10% milkfat and can contain up to as high as about 20% milkfat in certain rich, high quality ice cream products. The milkfat present in ice cream products can provide a significant number of calories, i.e. milkfat has a calorie density of about 9 calories per gram versus protein (e.g., present in nonfat milk solids) which provides only about 4 calories per gram. To reduce the number of calories, ice milks have been formulated to be low in milkfat (i.e., from 2 to 7% milkfat) by using primarily, or exclusively, nonfat milk solids in its place. However, ice milks containing relatively high percentages of nonfat milk solids can impart gritty or chalky mouthfeel impressions due to the overall higher level of solids that do not melt at mouth temperatures, as well as the higher concentration of crystallized lactose that can be present in nonfat milk solids. In addition, milkfat imparts a desirable, lubricious mouthfeel as it melts at mouth temperatures. Accordingly, due to the low level of milkfat present in ice milk products, they do not impart the same lubricious mouthfeel that is typically provided by ice cream products.

Certain polyol fatty acid polyesters have been suggested as low calorie substitutes for conventional triglyceride fats. For example, U.S. Pat. No. 3,600,186 to Mattson et al, issued Aug. 17, 1971, discloses low calorie food compositions in which at least a portion of the fat content of a fat-containing food is provided by a nonabsorbable, nondigestible sugar fatty acid ester or sugar alcohol fatty acid ester having at least 4 fatty acid ester groups with each fatty acid having from 8 to 22 carbon atoms. Unfortunately, regular ingestion of moderate to high levels of completely liquid forms of these polyol polyesters can produce undesirable laxative side effects, namely, leakage of the polyesters through the anal sphincter. By contrast, completely solid versions of these polyesters provide a sufficiently high solids content at mouth temperatures such that they taste waxy in the mouth when ingested.

As an alternative to these completely liquid or completely solid nondigestible/nonabsorbable polyol polyesters, certain intermediate melting polyol (e.g., sucrose) fatty acid polyesters have been developed that provide anal leakage control at body temperatures (i.e. at 98.6° F., 37° C.), without causing excessive oiliness when ingested at mouth temperatures (i.e., at 92° F., 33.3° C.). See European patent application 236,288 to Bernhardt, published Sept. 9, 1987, and European patent application 233,856 to Bernhardt, published Aug. 26, 1987. These intermediate melting polyol polyesters exhibit a unique rheology at body temperatures due to a matrix involving a minimal level of solids (e.g., about 12% or lower) to bind the remaining liquid portion. As a result, these intermediate melting polyol polyesters are sufficiently viscous and have a sufficiently high liquid/solid stability at body temperatures to control anal leakage. An example of such intermediate melting polyol polyesters are those obtained by substantially completely esterifying sucrose with a 55:45 mixture of fully hydrogenated (hardstock) and partially hydrogenated soybean oil fatty acid methyl esters. See Examples 1 and 2 from these European patent applications.

European patent applications 236,288 and 233,856 disclose these intermediate melting polyol polyesters to be useful as total or partial replacements for other fats in fat-containing food products, including ice cream and other fat-containing frozen desserts. For example, these intermediate melting polyol polyesters can be substituted for the milkfat present in conventional commercial ice cream formulations to provide lower calorie ice cream-type frozen desserts. However, the preparation of acceptable ice cream-type formulations from these intermediate melting polyol polyesters is not straightforward. Formulations containing these polyol polyesters and all of the remaining dessert ingredients (e.g., nonfat milk solids, sugar, etc.) do not mix together well, especially in large quantities, and tend to separate into two distinct phases.

Moreover, when these ice cream-type formulations are passed through a homogenizer, the intermediate melting polyol polyesters are dispersed in the aqueous phase as significantly larger particles (e.g. about 10 microns or greater), especially when compared to the

dispersed milkfat particles present in conventional ice cream products. This larger particle size occurs even if an oil-in-water emulsifier, such as polysorbate 60, is included in the formulation. The resulting frozen dessert products having these larger intermediate melting polyol polyester particles impart a gritty, sand-like impression, followed by a waxy mouthfeel impression that is unlike a conventional ice cream product. Accordingly, it would be desirable to be able to formulate a frozen dessert containing these polyol polyesters which imparts a smooth, creamy, nongritty mouthfeel impression like that provided by conventional ice cream products.

BACKGROUND ART

European patent application 236,288 to Bernhardt, published Sept. 9, 1987, discloses certain edible, wholly or partially nondigestible intermediate melting polyol (e.g., sucrose) fatty acid polyesters having certain rheological properties (e.g., viscosity, liquid/solid stability) at body temperatures. See page 4. Amongst the various uses disclosed for these intermediate melting polyol polyesters are as partial or total fat replacers in food products, including ice cream and other fat-containing frozen desserts. See page 14. See also European patent application 233,856 to Bernhardt, published Aug. 26, 1987, which discloses combinations of these intermediate melting polyol polyesters with digestible food materials (e.g., triglycerides) which act as a solvent that can be used in dairy products.

European patent application 290,065 to Guffey et al, published Nov. 9, 1988. discloses food or beverage compositions having altered flavor display which contain polar or intermediate polarity flavor compounds, as well as a fat phase containing edible, wholly or partially nondigestible intermediate melting sucrose fatty acid polyesters. Amongst the various examples of these food or beverage compositions are ice cream and other fat-containing frozen desserts. Example 2 discloses the preparation of an ice cream-like product by first mixing together half of the sucrose with carrageenan and liquid sugar, mixing together the remaining half of the sucrose with gelatin and hot water, combining these two mixtures with the remaining ingredients (milk, cream, corn syrup, egg yolks, intermediate melting sucrose polyesters, polysorbate 60, monoglyceride emulsifier, and vitamins), pasteurizing this combined mixture, and then homogenizing the pasteurized mixture at 2,000 psi in the first stage and at 500 psi in the second stage. This homogenized mixture is then slowly cooled to 80°-90° F. (26.7°-32.2° C.), and stored overnight at 40° F. (4.4° C.). Colorant and vanilla is then added to the cooled mixture which is then aerated and frozen to provide the ice cream-like product.

U.S Pat. No. 4,626,441 to Wolkstein, issued Dec. 2, 1986, discloses dietetic frozen desserts containing aspartame which are free of, or low in, milkfat, animal fat and/or vegetable fat, to provide a significant reduction in calories. Nondigestible, nonabsorbable sucrose fatty acid polyesters are specifically disclosed as being useful in replacing from about 10 to 100% of the milkfat typically present in such frozen desserts. See Column 4, lines 32-48. Example 4 discloses a mellorine frozen dessert containing 4-16% fat which can comprise 10 to 100% of these sucrose polyesters. Example 15 discloses the preparation of a frozen dessert by combining milkfat solids, nonfat milk solids, polydextrose, microcrystalline cellulose, fermented demineralized whey, aspartame and water, heating this mixture to dissolve the ingredients, pasteurizing the mixture, homogenizing the pasteurized mixture at about 2200 psi in the first stage and at 500 psi in the second stage, cooling the homogenized mixture to 38° F. (3.3° C.), aging the cooled mixture for 20 hours, adding color and flavor to the aged mixture, and then freezing the flavored mixture while blowing in air to 120% overrun. At the end of this example, it is indicated that sucrose polyesters can be substituted for about 50% of the milkfat solids to further reduce the calorie content.

U.S. Pat. 4,789,664 to Seligson et al, issued Dec. 6, 1988, discloses food compositions containing certain minimum levels of both nondigestible, nonabsorbable sucrose fatty acid polyesters and vegetable (e.g., soy) protein for the purpose of lowering plasma cholesterol and triglyceride levels. Specific forms of these food compositions include ice cream and other frozen desserts where the casein is replaced by vegetable protein and the milkfat is replaced by the sucrose polyesters. The sucrose polyesters disclosed as being useful in these food compositions include intermediate melting sucrose polyesters. See Column 9, line 29, to Column 10, line 68. Example 4 describes the preparation of a frozen dessert similar to commercial ice cream. This dessert is prepared by first melting together triglycerol monostearate and stearic acid soap, combining this melted mixture with high fructose corn syrup, sucrose and water, and then subjecting the resulting mixture to high shear to provide an emulsifier-water dispersion. A melted mixture of triglyceride oil, propylene glycol monostearate and sucrose polyesters (derived from soybean oil (Iodine Value 107) fatty acids) is blended into this emulsifier-water dispersion and is then subjected to additional high shear mixing. The resulting emulsion is cooled and then flavor is added with additional high shear mixing. A portion of this flavored emulsion is blended in a home mixer operated at high speed with milk, and a dry mix containing sucrose, dextrose, tapioca starch, soy protein isolate, coloring, and a stabilizing system (carboxymethyl cellulose, citric acid, tetrasodium pyrophosphate, hydroxypropylcellulose, and carrageenan gum). The resulting aerated mixture is then frozen to provide the dessert.

European patent application 290,420 to Guffey et al, published Nov. 9, 1988, discloses shortening products made with edible, wholly or partially nondigestible intermediate melting sucrose polyesters, as well as food compositions having enhanced flavors due to the addition of these shortenings. Amongst the various examples of these food compositions are ice cream, ice milk, ices, sherbets, sorbets, mellorines, milkshakes, and other fat-containing frozen desserts. See page 6.

DISCLOSURE OF THE INVENTION

The present invention relates to low calorie frozen desserts, in particular ice cream-like products, which comprise:

(a) from about 2 to about 20% fat comprising from about 30 to 100% of edible, wholly or partially nondigestible polyol fatty acid polyesters having at least 4 fatty acid ester groups, wherein the polyol contains at least 4 hydroxy groups and wherein each fatty acid group has from 2 to 24 carbon atoms, the polyol polyester further having:

(1) a viscosity of from about 2.5 to about 200 poise at 100° F. (37.8° C.) and at a shear rate of 10 seconds^{-1};

(2) a liquid/solid stability of at least about 30% at 100° F. (37.8° C.);
(b) from about 3 to about 15% milk solids other than fat;
(c) an effective amount of a sweetener;
(d) an effective amount of an oil-in-water emulsifier;
(e) an effective amount of a flavoring substance;
(f) from about 50 to about 75% water;
(g) wherein the fat is substantially homogeneously dispersed in the aqueous phase as emulsified fat particles having an average particle size of about 5 microns or less.

Surprisingly, the low calorie frozen dessert products of the present invention have a smooth, creamy, nongritty mouthfeel that is more like that of a conventional ice cream product. This is believed to be due to the fact that the intermediate melting polyol polyesters are dispersed as relatively fine emulsified fat particles in the continuous aqueous phase, similar to the dispersion of milkfat particles in a conventional ice cream product.

The low calorie frozen desserts of the present invention having this smooth, creamy, nongritty mouthfeel impression are obtained by the process which comprises the step of:

(a) forming a mixture consisting essentially of:
(1) from about 30 to about 50% fat comprising from about 70 to 100% of edible, wholly or partially nondigestible intermediate melting polyol polyesters, as previously defined;
(2) from about 10 to about 30% milk solids other than fat,
(3) from 0 to about 10% of a sweetener,
(4) from 0 to about 3% of a stabilizer,
(5) an effective amount of an oil-in-water emulsifier, and
(6) from about 25 to about 45% water;
(b) homogenizing the mixture of step (a) in a manner such that a stable oil-in-water preemulsion is formed wherein the fat is substantially homogeneously dispersed in the aqueous phase as emulsified fat droplets;
(c) forming a second mixture comprising:
(1) from about 10% to about 30% of the preemulsion of step (a),
(2) from 0 to about 15% added triglyceride fat;
(3) from about 2 to about 14% added milk solids other than fat,
(4) from 0 to about 20% added sweetener,
(5) from about 36.5 to about 73.5% added water,
(6) the combined amount of components (1) and (2) being sufficient to provide from about 2 to about 20% total fat,
(7) the combined amount of components (1) and (3) being sufficient to provide from about 3 to about 15% total milk solids other than fat,
(8) the combined amount of components (1) and (4) being sufficient to provide an effective amount of sweetener, and
(9) the combined amount of components (1) and (5) being sufficient to provide from about 50 to about 75% total water;
(d) homogenizing and pasteurizing the second mixture of step (c) in a manner such that a homogenized pasteurized mixture is obtained wherein the fat is substantially homogeneously dispersed in the aqueous phase as emulsified fat droplets having an average droplet size of about 5 microns or less; and
(e) at least partially freezing the homogenized pasteurized mixture of step (d) to provide the frozen dessert product.

A. Definitions

As used herein, the term "frozen dessert" refers to partially frozen or fully hardened homogenized pasteurized mixtures containing fat, milk solids other than fat, sweetener, flavoring substances, emulsifier, water, and other optional ingredients such as stabilizers, egg yolk solids and coloring. Frozen desserts of the present invention can be firm, solid products, or can be pumpable, semisolid products (e.g., can be in the form of soft serve-type products). Frozen desserts of the present invention include, but are not limited to, products similar in form and fat content to conventional ice cream, frozen custards (also called "french" ice creams), mellorines, ice milks, and sherbets. Particularly preferred frozen desserts of the present invention are in the form of ice cream-like products.

As used herein, the term "fat" refers to the total amount of triglyceride fat and intermediate melting polyol polyesters that are present in the frozen desserts of the present invention, as well as ingredient mixtures used in preparing such products. Milkfat (also called "butterfat") is the primary, or exclusive, triglyceride fat present in such products or mixtures, although other triglyceride fats can also be present, typically in minor amounts as part of the source of flavoring substances.

As used herein, the term "milk solids other than fat" refers to the total amount of milk solids (on a dry basis) exclusive of milkfat, that are present in the frozen desserts of the present invention, or ingredient mixtures used in preparing such products. Milk solids other than fat include milk protein (e.g. casein), milk sugars (e.g. lactose), minerals, and vitamins. Although milk solids other than fat are usually derived from dairy-based sources, nondairy-based sources of protein, such as vegetable (e.g., soy) protein, can be wholly or partially substituted for such solids.

By "wholly nondigestible" is meant that substantially all of the intermediate melting polyol polyesters are not digested by the body, i.e. the polyesters pass through the digestive system substantially the same as when ingested. The term "partially nondigestible" means that at least about 30% of the intermediate melting polyol polyesters are not digested. Preferably at least about 70% of the intermediate melting polyol polyesters are not digested.

By "liquid/solid stability" as used herein is meant that the liquid portion of the intermediate melting polyol polyesters does not readily separate from the solid portion at body temperatures, i.e., the intermediate melting polyol polyesters appear to be a solid even though up to 95% or more of the polyesters are liquid. Liquid/solid stability is measured by centrifuging a sample of the intermediate melting polyol polyesters at 60,000 rpm for one hour at 100° F. (37.8° C.). Liquid/solid stability is defined as: 100% minus the volume percentage of the intermediate melting polyol polyesters that separate as a liquid after centrifuging.

As used herein, the term "comprising" means various components can be conjointly employed in the frozen dessert products of the present invention, or in ingredient mixtures used in preparing such products. Accordingly, the term "comprising" encompasses the more restrictive terms "consisting essentially of" and "consisting of."

All percentages and proportions used herein are by weight unless otherwise specified.

B. Composition of Frozen Dessert Products

1. Fat

A key component of the frozen dessert products of the present invention, especially in terms of textural (e.g., mouthfeel) properties, is the fat. The particular amount of fat present in these frozen desserts can vary depending upon the textural properties and product form desired. Frozen desserts of the present invention can comprise from about 2 to about 20% fat. Particularly preferred frozen desserts of the present invention comprise from about 10 to about 20%, most preferably from about 14 to about 18%, fat. The fat level of these preferred frozen desserts corresponds to the milkfat level of conventional ice cream products. Accordingly, these preferred frozen desserts are particularly desirable for providing ice cream-like products.

A particularly important characteristic of the fat present in the frozen desserts of the present invention is the fact that it is substantially homogeneously dispersed in the aqueous phase as emulsified particles having an average particle size of about 5 microns or less, preferably about 2 microns or less. This dispersion of relatively fine emulsified fat particles is similar to the dispersion of milkfat particles in a conventional ice cream product. Accordingly, and surprisingly, frozen dessert products of the present invention comprising this dispersion of finer emulsified fat particles have a smooth, creamy, nongritty mouthfeel that is more like that of conventional ice cream products. By contrast, it has been found that frozen desserts having larger dispersed emulsified fat particles (e.g., about 10 microns or greater) impart a gritty, sand-like impression, followed by a waxy mouthfeel impression that is unlike conventional ice cream products.

The fat present in the frozen dessert products of the present invention comprises in whole, or in part, certain intermediate melting polyol polyesters that provide reduced calorie benefits, the balance of the fat being a digestible triglyceride fat, usually milkfat. The proportion of intermediate melting polyol polyesters which are present in the fat depends upon the reduced calorie benefits desired, the total level of fat in the product, and the textural, in particular, mouthfeel properties, desired. For frozen dessert products of the present invention, the fat can comprise from about 30 to 100% of these polyol polyesters. Preferably, the fat comprises from about 50 to 100% of these polyol polyesters.

The intermediate melting polyol polyesters useful in the present invention are edible, wholly or partially nondigestible polyol fatty acid polyesters having at least 4 fatty acid ester groups, wherein the polyol(e.g., a sugar, a sugar alcohol or a sugar derivative such as an alkyl glycoside) contains at least 4 (preferably from 4 to 8) hydroxy groups prior to esterification, and wherein each fatty acid group has from 2 to 24 carbon atoms. These intermediate melting polyol polyesters are particularly characterized by the following physical properties: (a) a viscosity of from about 2.5 to about 200 poise at 100° F. (37.8° C.) and at a shear rate of 10 seconds^{-1}; and (b) a liquid/solid stability of at least about 30% at 100° F. (37.8° C.).

To measure the viscosity of a sample of the intermediate melting polyol polyesters, a plate and cone viscometer is used. The viscosity is measured after 10 minutes of shear at a constant shear rate of 10 sec^{-1}. At 100° F. (37.8° C.), the polyol polyesters useful in the present invention typically have a viscosity in the range of from about 2.5 to about 200 poise at a shear rate of 10 seconds^{-1}. Preferably, the polyol polyesters have a viscosity of from about 5 to about 100 poise. Most preferred polyol polyesters have a viscosity of from about 20 to about 60 poise.

As discussed above, the present intermediate melting polyol polyesters have a high liquid/solid stability inasmuch as the liquid portion of these polyol polyesters does not readily separate from the solid portion. At 100° F. (37.8° C.), these intermediate melting polyol polyesters have a liquid/solid stability of at least about 30%, preferably at least about 50%, more preferably at least about 70%, and most preferably at least about 80%.

Moreover, the present intermediate melting polyol polyesters are sufficiently viscous and stable even at relatively low levels of solids. The Solid Fat Content (SFC) provides a reasonable approximation of the percent by weight solids of a particular fatty material at a given temperature. The present polyol polyesters desirably have a Solid Fat Content at 98.6° F. (37° C.) of about 20% or less. Particularly preferred SFC values at 98.6° F. (37° C.) are in the range of from about 4 to about 20%, and most preferably in the range of from abont 6 to about 15%.

Preferred intermediate melting polyol polyesters for use in the present invention are selected from sugar fatty acid polyesters and sugar alcohol fatty acid polyesters. The term "sugar" is used herein in its generic sense to include monosaccharides, disaccharides, oligosaccharides, and polysaccharides. The term "sugar alcohol" is used in its generic sense to refer to the reduction product of sugars wherein the aldehyde or ketone group has been reduced to an alcohol. Preferred sugars or sugar alcohols contain 4 to 8 hydroxy groups prior to esterification. The fatty acid ester compounds are prepared by reacting a sugar or sugar alcohol with fatty acids as discussed below.

Examples of suitable monosaccharides are those containing 4 hydroxy groups such as xylose, arabinose, ribose and methylglucoside; the sugar alcohol derived from xylose, i.e., xylitol, is also suitable. The monosaccharide erythrose is not suitable since it only contains 3 hydroxy groups; however, the sugar alcohol derived from erythrose, i.e., erythritol, contains 4 hydroxy groups and is thus suitable. Among 5 hydroxy-containing monosaccharides that are suitable for use herein are glucose, mannose, galactose, fructose, and sorbose. A sugar alcohol derived from sucrose, glucose, or sorbose, e.g., sorbitol, contains 6 hydroxy groups and is also suitable as the alcohol moiety of the fatty acid ester compound. Examples of suitable disaccharides are maltose, lactose, and sucrose, all of which contain 8 hydroxy groups.

In preparing the intermediate melting polyol polyesters useful in the present invention, the polyol (e.g., a sugar or sugar alcohol compound such as those identified above) is esterified with fatty acids having from 2 to 24 (preferably from 8 to 22), carbon atoms. Examples of such fatty acids are acetic, butyric, caproic, caprylic, capric, lauric, myristic, myristoleic, palmitic, palmitoleic, stearic, oleic, elaidic, ricinoleic, linoleic, linolenic, eleostearic, arachidic, behenic, and erucic. The fatty acids can be derived from suitable naturally occurring or synthetic fatty acids and can be saturated or unsaturated, including positional and geometric isomers. The polyol polyesters of this invention are usually, but not necessarily, mixed esters of fatty acids, rather than esters of a single type of fatty acid.

Fatty acids per se or naturally occurring fats and oils can serve as the source for the fatty acid portion of the polyol fatty acid polyester. For example, rapeseed oil provides a good source for C_{22} fatty acid. C_{16}–C_{18} fatty acids can be provided by tallow, soybean oil, cottonseed oil. Shorter chain fatty acids (e.g., C_{12}–C_{14} fatty acids) can be provided by coconut, palm kernel, or babassu oils. Corn oil, lard, olive oil, palm oil, peanut oil, safflower seed oil, sesame seed oil, and sunflower seed oil, are examples of other natural oils which can serve as the source of the fatty acid component. The fatty acids can be saturated, unsaturated, or mixtures thereof. The unsaturated fatty acids can include positional and geometric isomers (e.g., cis and trans isomers), or mixtures thereof. In order to provide the required physical properties, the polyols are preferably esterified with particular kinds of fatty acids. Preferably, at least about 70% of the fatty acids are selected from the group consisting of lauric, myristic, palmitic, stearic, oleic and elaidic ($C_{18:1}$), linoleic ($C_{18:2}$), behenic acids and mixtures thereof.

Iodine Value is a measure of the degree of unsaturation of fatty acids that are esterified on the polyol. The intermediate melting polyol polyesters usually have an Iodine Value of from about 10 to about 70. A preferred group of these polyesters have Iodine Values of from about 15 to about 60. These preferred polyesters also have a fatty acid composition characterized by: (a) not more than about 0.6% fatty acids having 3 or more double bonds; (b) not more than about 20% fatty acids having 2 or more double bonds; and (c) not more than about 35% of the fatty acid double bonds are trans-double bonds. The percent trans-double bonds is calculated as follows:

$$P = \frac{D_{trans}}{D_{total}} \times 100\%$$

where

P = percent trans-double bonds

D_{trans} = trans fatty acids (by IR)

D_{total} = total number of double bonds

Preferred fatty acid compositions for these preferred polyesters are:

less than about 12% palmitic acid;

from about 30 to about 70% stearic acid;

from about 15 to about 60% oleic and elaidic ($C_{18:1}$) acids;

less than about 12% linoleic ($C_{18:2}$) acid; and

less than about 0.6% linolenic ($C_{18:3}$) acid.

Most preferred fatty acid compositions for these preferred polyesters are:

less than about 12% palmitic acid;

from about 40 to about 70% stearic acid;

from about 20 to about 50% oleic and elaidic ($C_{18:1}$) acid;

less than about 12% linoleic ($C_{18:2}$) acid; and

less than about 0.6% linolenic ($C_{18:3}$) acid.

With regard to reduced calorie benefits, a characterizing feature of the intermediate melting polyol polyesters useful in the present invention is that they predominantly contain at least 4 fatty acid ester groups. Polyol fatty acid polyester compounds that contain 3 or less fatty acid ester groups are digested in the intestinal tract much in the manner as ordinary triglyceride fats, but polyol fatty acid polyester compounds that contain 4 or more fatty acid ester groups are digested to a lesser extent and thus have the desired reduced calorie properties.

Highly preferred intermediate melting polyol polyesters are sucrose fatty acid polyesters. Preferred sucrose fatty acid polyesters have the majority of their hydroxy groups esterified with fatty acids. Preferably at least about 85%, and most preferably at least about 95%, of the esters are octaesters, heptaesters, hexaesters, or mixtures thereof. Preferably, no more than about 40% of the esters are hexaesters or heptaesters, and at least about 60% of the esters are octaesters. Most preferably at least about 70% of the esters are octaesters. It is also most preferred that the polyesters have a total content of penta- and lower esters of not more than about 3%.

The intermediate melting polyol polyesters suitable for use herein can be prepared by a variety of methods well known to those skilled in the art. These methods include: transesterification of the polyol with methyl, ethyl or glycerol fatty acid esters using a variety of catalysts; acylation of the polyol with a fatty acid chloride; acylation of the polyol with a fatty acid anhydride; and acylation of the polyol with a fatty acid, per se. As an example, the preparation of sugar and sugar alcohol fatty acid esters is described in U.S. Pat. Nos. 2,831,854, 3,963,699, 4,517,360 and 4,518,772, all of which are incorporated by reference.

The preferred intermediate melting polyol polyesters described above having maximum levels of fatty acids with two or more double bonds, as well as trans-double bonds, can be prepared using two source oil streams. For example, a sugar or sugar alcohol is esterified with a mixture of fatty acids from a primary source oil and a fully hydrogenated secondary source oil in a ratio between about 20:80 and about 80:20, preferably between about 50:50 and about 75:25. The primary source oil has an Iodine Value between about 65 and about 100, preferably between about 75 and about 95, and the fully hydrogenated oil has an Iodine Value between about 1 and about 12, preferably between about 1 and about 8. The partially hydrogenated portion is derived by a catalytic process which provides low levels of polyunsaturated fatty acids, and low levels of trans configurated double bonds. For example, the following hydrogenation conditions are suitable for obtaining partially hydrogenated oils having low levels of polyunsaturated acids and trans-double bonds: 0.02% by weight nickel catalyst, 40 psig pressure, 270° F. (135° C.) initial temperature, and 320° F. (160° C.) reaction temperature.

An alternative method for preparing these preferred polyol polyesters involves:

(1) esterifying a polyol with a mixture of fatty acids from a primary source oil and a secondary fully hydrogenated source oil in a ratio between about 20:80 and about 80:20, the primary source oil having an Iodine Value between about 65 and about 100, and the fully hydrogenated oil having an Iodine Value between about 1 and about 12; and

(2) esterifying a polyol with a mixture of fatty acids from a tertiary source oil, the tertiary source oil having an Iodine Value of from about 65 to about 100; and

(3) blending the esterified products of steps (1) and (2).

The preferred Iodine Values for the primary and tertiary streams are from about 75 to about 95 and the preferred Iodine Values for the secondary stream are from about 1 to about 8. The ratio of polyol polyesters prepared from a primary source oil stream to polyol polyesters prepared from a secondary source oil stream

is between about 20:80 and 80:20, preferably between about 50:50 and 75:25.

Source oils particularly suitable for use in preparing these preferred polyol polyesters include hardened and partially hardened canola, corn, safflower, high oleic safflower, soybean, peanut, sunflower or high oleic sunflower oils. Mixtures of these oils are also suitable. See U.S. application Ser. No. 421,867, to Robert W. Johnston, Josephine L. Kong-Chan, Richard G. Schaefermeyer and Paul Seiden, filed October 16, 1989 (herein incorporated by reference), which discloses these preferred polyol polyesters and their preparation.

2. Milk Solids Other Than Fat

Another key component of the frozen dessert products of the present invention are the milk solids other than fat. These milk solids other than fat enhance the palatability of the frozen dessert product, increase its food value and are a more economical source of solids than fat. The particular amount of milk solids other than fat present in these frozen desserts can vary, particularly depending upon the amount of fat which is present. Generally, the level of milk solids other than fat varies inversely to the level of fat (i.e., the higher the level of fat, the lower the level of milk solids other than fat) in order to maintain the proper total solids balance and to insure the proper textural and storage properties for the resulting frozen dessert product. Frozen desserts of the present invention can generally comprise from about 3 to about 15% milk solids other than fat. For preferred frozen desserts of the present invention in the form of ice cream-like products, the level of milk solids other than fat is typically from about 5 to about 10%.

A variety of dairy-based sources can be used to provide milk solids other than fat for frozen dessert products of the present invention. These dairy-based sources include cream, dry cream, fluid whole milk, concentrated whole milk, evaporated whole milk, sweetened condensed whole milk, superheated condensed whole milk, dried whole milk, skim milk, concentrated skim milk, evaporated skim milk, condensed skim milk, superheated condensed skim milk, sweetened condensed skim milk, sweetened condensed part-skim milk, nonfat dry milk, sweet cream buttermilk, condensed sweet cream buttermilk, dried sweet cream buttermilk, concentrated skim milk from which a portion of the lactose has been removed, casein, modified casein, casein prepared by precipitation with gums, ammonium caseinate, calcium caseinate, sodium caseinate, sweet dairy whey, neutralized acid whey, modified whey, whey protein concentrate, concentrated cheese whey and dried cheese whey, as well as mixtures of these sources. (The dairy-based sources of milk solids other than fat can also provide milkfat that forms a portion of the fat present in the frozen desserts of the present invention.) Particularly preferred dairy-based sources of milk solids other than fat for use in the present invention are condensed skim milk, sweetened condensed whole milk, fluid whole milk, nonfat dry milk, cream, and mixtures thereof. (Nondairy-based sources of protein such as vegetable, e.g., soy, protein can also be substituted in whole or in part for the milk solids other than fat.)

3. Sweeteners and Optional Bulking Agents

Another key component of the frozen dessert products of the present invention is an effective amount of a sweetener or sweeteners. Milk solids other than fat can contain a fairly high level of lactose (e.g., on the order of about 55%). However, lactose generally provides insufficient sweetness, particularly relative to higher intensity sweeteners such as sucrose. Accordingly, a higher intensity sweetener or sweeteners is needed in addition to any lactose that is present in the milk solids other than fat.

Suitable higher intensity nutritive carbohydrate sweeteners include sucrose, glucose, fructose, maltose, corn syrups including high fructose corn syrups and high maltose corn syrups, invert sugar, maple syrup, maple sugar, honey, brown sugar, refiners syrup (also known as liquid sugar or liquid sucrose), and mixtures of these sweeteners. The amount of nutritive sweetener included is selected to provide the desired sweetness intensity in the frozen dessert product. Usually, the nutritive sweetener comprises from about 10 to about 20% of the product. Preferably, the nutritive sweetener comprises from about 13 to about 16% of the product.

If an extra calorie reduction benefit is desired, noncaloric or reduced calorie sweeteners can be used wholly or partially in place of the nutritive carbohydrate sweeteners. Suitable noncaloric or reduced calorie sweeteners include, but are not limited to, aspartame; saccharin; alitame, thaumatin; dihydrochalcones; cyclamates; steviosides; glycyrrhizins, synthetic alkoxy aromatics, such as Dulcin and P-4000; sucralose, suosan; miraculin; monellin; sorbitol; xylitol; talin; cyclohexylsulfamates; substituted imidazolines; synthetic sulfamic acids such as acesulfame, acesulfam-K and n-substituted sulfamic acids; oximes such as perilartine; rebaudioside-A; peptides such as aspartyl malonates and succanilic acids; dipeptides; amino acid based sweeteners such as gem-diaminoalkanes, meta-aminobenzoic acid, L-aminodicarboxylic acid alkanes, and amides of certain alpha-aminodicarboxylic acids and gem-diamines; and 3-hydroxy-4-alkyloxyphenyl aliphatic carboxylates or heterocyclic aromatic carboxylates. The particular amount of noncaloric or reduced calorie sweetener included in the frozen dessert product will depend on the sweetness intensity of the particular sweetener and the sweetness effect desired.

When these noncaloric or reduced calorie sweeteners are used, it can be desirable to include bulking or bodying agents. Suitable bulking or bodying agents include partially or wholly nondigestible carbohydrates, for example, polydextrose and cellulose or cellulose derivatives, such as carboxymethylcellulose, carboxyethylcellulose, hydroxypropylcellulose, methylcellulose, hydroxypropyl methylcellulose, and microcrystalline cellulose. Other suitable bulking/bodying agents include starches, gums (hydrocolloids), fermented whey, tofu, and maltodextrins.

A particularly desirable class of nondigestible bulking agents are certain 5-C-hydroxymethyl hexose compounds and their derivatives that act like "reduced calorie sugars" in terms of their ability to provide the functional properties of nutritive carbohydrate sweeteners (e.g., sucrose), but without the sweetness or the calories. See U.S. application Ser. No. 339,531 to Adam W. Mazur, filed Apr. 20, 1989 (herein incorporated by reference), which discloses these reduced calorie sugars and their synthesis and U.S. application Ser. No. 337,725 to Adam W. Mazur, George D. Hiler, Jr., Gordon K. Stipp and Bernard W. Kluesener, filed Apr. 17, 1989 (herein incorporated by reference), for an alternative synthesis of the 5-C-hydroxymethyl aldohexoses. These reduced calorie sugars can comprise from about 10 to about 20% of the product.

The most preferred reduced calorie sugars include 5-C-hydroxymethyl-L-arabino-hexose;

5-C-hydroxymethyl-D-xylo-hexose;
1,6-anhydro-5-C-hydroxymethyl-β-L-altropyranose;
1,6-anhydro-5-C-hydroxymethyl-β-L-idopyranose;
1,6-anhydro-5-C-hydroxymethyl-β-L-gulopyranose;
methyl 5-C-hydroxymethyl-D-xylo-hexoside;
ethyl 5-C-hydroxymethyl-L-arabino-hexoside;
5-C-hydroxymethyl-L-arabino-hexosyl glycerol;
5-C-hydroxymethyl-α-D-xylohexopyranosyl-β-D-fructo furanoside;
5-C-hydroxymethyl-αL-arabino-hexopyranosyl-(1→4)-D-galactopyranose;
5-C-hydroxymethyl-αL-arabino-hexopyranosyl-(1→6)-D-galactopyranose;
5-C-hydroxymethyl-αL-arabino-hexopyranosyl-α-D-glucosyl-βD-fructose;
5-C-hydroxymethyl-D-galactopyranosyl-D-glucitol;
arabinogalactan derivatives wherein at least one galactosyl group is converted to a 5-C-hydroxymethyl group;
and mixtures thereof.

4. Flavoring Substances

Another key component of the frozen dessert products of the present invention is an effective amount of a flavoring substance. Suitable flavoring substances can be in the form of whole or comminuted food pieces, purees, extracts, concentrates and essences, and can be derived from natural and/or synthetically produced sources. Examples of suitable natural flavorings include: (1) citrus and noncitrus fruit flavors (e.g., whole or comminuted fresh fruit, fruit purees, fruit concentrates, extracts or essences, candied or glazed fruits, and dried fruits); (2) sugar-free versions of such fruit flavorings; (3) flavors derived from botanicals; (4) spices; (5) chocolate, cocoa or chocolate liquor; (6) coffee; (7) natural flavorings obtained from vanilla beans; (8) nuts, including nutmeats and nut extracts from pecans, walnuts, almonds, pistachios, filberts and peanuts. Other sources of natural flavorings include liqueur flavorings such as alcohol, whiskey and other distilled beverages, fruit brandy distillate and brandy flavor essence, and fruit liqueurs. Examples of synthetically derived flavorings include aromatic chemicals and imitation flavors. The particular amount of flavoring substance included in the frozen dessert products of the present invention will depend upon the flavor effects desired and the particular flavoring substance used. Usually, the flavoring substance comprises from about 0.01 to about 20% of the product, and typically from about 0.2 to about 12% of the product.

5. Oil-in-Water Emulsifiers

Another key component of the frozen dessert products of the present invention is an effective amount of an oil-in-water emulsifier. The oil-in-water emulsifier is necessary in order to disperse the fat droplets or particles comprising the intermediate melting polyol polyesters in the continuous aqueous phase and to maintain a stable oil-in-water emulsion. In addition, emulsifiers facilitate air incorporation during freezing to provide a finer dispersion of air cells that imparts a smoother body and texture, and slower meltdown, to the resulting frozen dessert. Suitable oil-in-water emulsifiers for use in the present invention include distilled and undistilled mono- and diglycerides of C_{16}-C_{18} fatty acids (e.g., DIMODAN 0), ethoxylated mono- and diglycerides, polyoxyethylene derivatives of hexahydric alcohols in particular polyoxyethylene (20) sorbitan monostearate (e.g., polysorbate 60), polyoxyethylene (20) sorbitan tristearate (e.g., polysorbate 65), and polyoxyethylene (20) sorbitan monooleate (e.g., polysorbate 80), propylene glycol monoesters of C_{16}-C_{18} fatty acids, diacetyl sodium sulfosuccinate, as well as mixtures of these emulsifiers. Preferred emulsifiers are the monoglycerides, polyoxyethylene (20) sorbitan monostearate, and mixtures thereof. The particular amount of oil-in-water emulsifier which is effective will typically depend upon the emulsifier used and the particular composition of the frozen dessert product, in particular the level of fat and intermediate melting polyol polyesters present. Usually, the frozen dessert product comprises from about 0.05 to about 2% emulsifier. Preferably, the emulsifier is included in the product in an amount of from about 0.1 to about 0.5%.

6. Water

Another key component of the frozen dessert products of the present invention is water. Water provides the continuous aqueous phase in which the emulsified fat particles, and other components present in the frozen dessert product, are dispersed, dissolved or suspended. Upon freezing, this continuous aqueous phase provides ice crystals which impart structural integrity and stability to the product. The source of water for the frozen dessert product can be added water, or can be supplied from other fluid dairy ingredients, such as those used to supply milk solids other than fat. The level of water present in the frozen dessert products of the present invention can vary depending upon the textural properties desired and the particular level of the remaining components. Usually, frozen dessert products of the present invention comprise from about 50 to about 75% water. Preferably, frozen desserts of the present invention comprise from about 55 to about 65% water.

7. Other Optional Ingredients

The frozen dessert products of the present invention can include other optional ingredients typically present in conventional frozen desserts. A particularly prominent example of optional ingredients often included in frozen dessert products are stabilizers. Stabilizers produce a smoothness in the textural properties of the product, retard or reduce ice crystal growth during storage of the product, provide uniformity in the product and resistance to melting. Stabilizers typically function through their ability to form gel structures in the water or their ability to combine with the water by hydration. (Certain of these stabilizers can also function as bulking or bodying agents if noncaloric or reduced calorie sweeteners are used.) Suitable stabilizers include sodium alginate, propylene glycol alginate, calcium sulphate, gelatin, gum acacia, guar gum, gum karaya, locust bean gum, gum tragacanth, carrageenan and salts thereof, xanthan gum, microcrystalline cellulose, cellulose ethers such as methyl cellulose, hydroxypropyl cellulose, hydroxypropylmethyl cellulose, carboxymethyl cellulose and its sodium salt, as well as mixtures of these stabilizers. Preferred stabilizers are carrageenan, gelatin, and mixtures thereof. The amount of stabilizer included in the frozen desserts of the present invention is typically that of conventional frozen desserts, e.g., in an amount of up to about 1% (typically from about 0.05 to about 0.5%) of the product.

Another optional ingredient which can be included in frozen dessert products of the present invention are egg yolk solids. Egg yolk solids are typically included in frozen dessert products in the form of frozen custards or "french" ice creams. Suitable sources of egg yolk solids include liquid egg yolks, frozen egg yolks, dried egg yolks, liquid whole eggs, frozen whole eggs, sugared

frozen egg yolks, salted frozen egg yolks, dried whole eggs, or combinations of the foregoing egg yolk substances. When egg yolk solids are used, they are typically included at levels typically present in such frozen dessert products, e.g., in amounts of from about 1 to about 2% of the product.

Other optional ingredients that can be included in frozen dessert products of the present invention include mineral salts such as sodium and disodium citrate, disodium phosphate, tetrasodium pyrophosphate, sodium hexametaphosphate, calcium oxide, magnesium oxide and the like. These mineral salts are typically included for the purpose of improving the properties of the mixture of ingredients during preparation of the frozen dessert product, as well as improving the characteristics of the resulting frozen dessert product. Natural or artificial colorings can also be included in frozen dessert products of the present invention.

The frozen desserts of the present invention, especially the intermediate melting polyol polyesters therein, can be fortified with vitamins and minerals, particularly the fat-soluble vitamins. U.S. Pat. No. 4,034,083 to Mattson (herein incorporated by reference) discloses polyol fatty acid polyesters fortified with fat-soluble vitamins. The fat-soluble vitamins include vitamin A, vitamin D, vitamin E, and vitamin K. Vitamin A is a fat-soluble alcohol of the formula $C_{20}H_{29}OH$. Natural vitamin A is usually found esterified with a fatty acid; metabolically active forms of vitamin A also include the corresponding aldehyde and acid. Vitamin D is a fat-soluble vitamin well known for use in the treatment and prevention of rickets and other skeletal disorders. Vitamin D comprises sterols, and there are at least 11 sterols with vitamin D-type activity. Vitamin E (tocopherol) is a third fat-soluble vitamin which can be used in the present invention. Four different tocopherols have been identified (alpha, beta, gamma and delta), all of which are oily, yellow liquids, insoluble in water but soluble in fats and oils. Vitamin K exists in at least three forms, all belonging to the group of chemical compounds known as quinones. The naturally occurring fat-soluble vitamins are K_1 (phylloquinone), K_2 (menaquinone), and K_3 (menadione). The amount of the fat-soluble vitamins employed herein to fortify the present frozen dessert products can vary. If desired, the products can be fortified with a recommended daily allowance (RDA), or increment or multiple of an RDA, of any of the fat-soluble vitamins or combinations thereof. It is preferred that the products be supplemented with 0.88 to 1.1 mg. vitamin E in the form of d-alpha-tocopherol acetate per gram of the intermediate melting polyol polyesters.

Vitamins that are nonsoluble in fat can similarly be included in the present frozen dessert products. Among these vitamins are the vitamin B complex vitamins, vitamin C, vitamin G, vitamin H, and vitamin P. The minerals include the wide variety of minerals known to be useful in the diet, such as calcium, magnesium, and zinc. Any combinations of vitamins and minerals can be used in the present frozen dessert products.

C. Process for Preparing Frozen Dessert Products

1. Formation of Preemulsion Containing Intermediate Melting Polyol Polyesters

A key aspect of the process for preparing the frozen dessert products of the present invention is the initial formation of an oil-in-water preemulsion containing the intermediate melting polyol polyesters. This preemulsion is particularly characterized by the fact that the intermediate melting polyol polyesters are substantially homogeneously dispersed in the aqueous phase as emulsified fat droplets which are believed to have an average droplet size of about 5 microns or less. To achieve this droplet size reduction, the process of the present invention forms this preemulsion by homogenizing a mixture which consists essentially of the intermediate melting polyol polyesters and only a portion of the remaining dessert ingredients (e.g., milk solids other than fat, sweetener, etc.). This is unlike the preparation of conventional frozen desserts, in particular ice cream, where all of the dessert ingredients, including the milk fat, are homogenized in a single step. Indeed, it has been found that if a mixture of intermediate melting polyol polyesters and all of the other dessert ingredients ar homogenized in a single step according to conventional ice cream making, the resulting homogenized mixture will contain much larger emulsified fat droplets (e.g., about 10 microns or greater), even if an oil-in-water emulsifier is used.

In preparing this preemulsion, a mixture is formed which consists essentially of the following ingredients:

(1) from about 30 to about 50% (preferably from about 35 to about 45%) fat comprising from about 70 to 100% (preferably from about 90 to 100%) intermediate melting polyol polyesters, as previously defined in part B of this application;

(2) from about 10 to about 30% (preferably from about 13 to about 24%) milk solids other than fat, as previously defined in part B of this application;

(3) from 0 to about 10% (preferably from about 1 to about 5%) of a sweetener, as previously defined in part B of this application;

(4) from 0 to about 3% (preferably from about 0.05 to about 2%) of a stabilizer, as previously defined in part B of this application;

(5) an effective amount (preferably from about 0.3 to about 0.8%) of an oil-in-water emulsifier; and

(6) from about 25 to about 45% (preferably from about 30 to about 40%) water.

As noted previously, the above mixture provides only a portion of the total milk solids other than fat and sweetener present in the final frozen dessert product. For example, such mixtures provide up to about 55% of the total milk solids other than fat and up to about 5% of the total sweetener for an ice cream-like frozen dessert product. In forming these mixtures, sources of milk solids other than fat that are low in milkfat (e.g., condensed skim milk, nonfat dry milk) are preferably used. The components of the mixture can be combined or added together in any appropriate fashion, typically in the following order of addition: (1) intermediate melting polyol polyesters; (2) liquid ingredients (e.g., milk and water); and (3) dry ingredients (e.g., sweetener and stabilizer).

During and/or after the ingredients are combined and mixed together, the mixture is heated to a temperature high enough to melt/liquefy the intermediate melting polyol polyesters and to dissolve the water-soluble ingredients so as to provide a pumpable, fluid mixture. Usually, this mixture is heated to a temperature of from about 140° to about 190° F. (about 60° to about 87.8° C.), and preferably to a temperature of from about 170° to about 180° F. (from 76.7° to about 82.2° C.). This heated, fluid mixture is then subjected to a homogenization step. Homogenization is usually accomplished by forcing this fluid mixture through the small orifice of a

homogenizer (or orifices in the case of a two-stage homogenizer), using a positive displacement plunger pump to furnish the appropriate pressure. This orifice consists of a valve and seat in which the two adjacent surfaces are parallel and lap smooth and is surrounded by an impact ring against which the fluid mixture of ingredients impinges as it leaves the valve. The breakup and size reduction of the fat droplets (e.g, the intermediate melting polyol polyesters) is caused by the shear forces that occur as a thin stream of the fluid mixture travels at a high velocity between the closely adjacent surfaces of the valve and the seat, and then by the shattering effect that occurs as the thin stream impinges on the impact ring upon leaving the valve. Size reduction of the fat droplets is also caused by cavitation effects. Cavitation is caused by the sudden release of pressure as the thin stream leaves the valve, which momentarily lowers the vapor pressure of the fluid mixture to a point where vapor pockets are formed. The fat droplets bounce back and forth inside these vapor bubbles and are shattered by impacts against the bubble walls, thus causing further size reduction.

The homogenization of this fluid mixture can be carried out by passing the heated fluid mixture through either a one-stage, or preferably two-stage homogenizer. See Arbuckle, *Ice Cream* (1977 Avi Publishing Co.), pp. 216-218, for suitable one-stage and two-stage homogenizers, including those manufactured and sold by Gaulin and Cherry-Burell Corp. In the case of one-stage homogenizers, suitable operating pressures can be in the range of from about 800 to about 3000 psi, with a preferred range of from about 1500 to about 2000 psi. In the case of two-stage homogenizers, the first stage can be operated at a pressure of from about 800 to about 3000 (preferably from about 1500 to about 2000) psi, while the second stage is operated at a pressure of from about 500 to about 1000 psi.

Homogenization of the fluid mixture of ingredients provides an oil-in-water preemulsion wherein the fat (e.g., intermediate melting polyol polyesters) is substantially homogeneously dispersed in the aqueous phase as emulsified fat droplets having an average droplet size of about 5 microns or less. Surprisingly, it has been found that this preemulsion is fairly stable, i.e. does not invert or separate into two phases. Accordingly, this preemulsion can be stored if cooled to and held at a temperature of about 40° F. (4.4° C.) or less, and preferably a temperature in the range of from about 32° to about 40° F. (about 0° to about 4.4° C.). This cooled preemulsion can be subsequently reheated for use in preparing the frozen dessert products of the present invention. More typically, this preemulsion is used fairly promptly in preparing frozen dessert products of the present invention to avoid the necessity of reheating it.

2. Formation of Homogenized Pasteurized Mixture From Preemulsion and Remaining Ingredients

In the next stage of the process of the present invention, a homogenized pasteurized mixture is formed from the previously described preemulsion and the remaining ingredients. In preparing this homogenized pasteurized mixture, a second mixture is formed which comprises the following ingredients:

(1) from about 10 to about 30% (preferably from about 15 to about 25%) of the preemulsion;

(2) from about 0 to about 15% (preferably from 0 to about 8%) added triglyceride fat, typically in the form of milkfat;

(3) from about 2 to about 14% (preferably from about 3 to about 6%) added milk solids other than fat;

(4) from 0 to about 20% (preferably from about 10 to about 20%) added sweetener; and

(5) from about 36.5 to about 73.5% (preferably from about 45 to about 55%) added water.

Other optional ingredients such as stabilizers and egg yolk solids can also be included in this second mixture. The sources of added milk solids other than fat can include those that are low in milkfat (e.g., milk), as well as those high in milkfat (e.g., cream). The combined amounts of the preemulsion, added triglyceride fat, added milk solids other than fat, added sweetener, and added water are such that this second mixture comprises:

(6) from 2 to about 20% (preferably from about 10 to about 20%) total fat;

(7) from about 3 to about 15% (preferably from about 5 to about 10%) total milk solids other than fat;

(8) an effective amount of (preferably from about 10 to about 20% total) sweetener; and

(9) from about 50 to about 75% (preferably from about 55 to about 65%) total water.

The components of the second mixture can be combined or added together in any appropriate fashion. A typical order of addition is as follows: (1) liquid ingredients (e.g., milk, cream, liquid sweetener and water); (2) preemulsion; and (3) dry ingredients (e.g. dry sweetener, stabilizer and egg yolk solids). Surprisingly, the preemulsion mixes well with the remaining dessert ingredients that comprise the second mixture, i.e., there is no phase separation in the second mixture. During and/or after the ingredients are combined and mixed together, the second mixture is heated to a temperature high enough to provide a pumpable, fluid mixture. Usually, this mixture is heated to a temperature of from about 135° to about 160° F. (about 57.2.° to about 71.1° C.), and preferably to a temperature from about 145° to about 150° F. (about 62.8° to about 65.6° C.)

The fluid second mixture is then homogenized and pasteurized in a manner such that a homogenized pasteurized mixture is obtained wherein the fat (e.g., intermediate melting polyol polyesters) is substantially homogeneously dispersed in the aqueous phase as emulsified fat droplets having an average droplet size of about 5 microns or less, preferably about 2 microns or less. Within these guidelines, the particular order of the pasteurization and homogenization steps is not critical in preparing the frozen dessert products of the present invention. For example, the fluid second mixture can be homogenized, and then pasteurized, or if desired, pasteurized and then homogenized. Typically, this homogenized pasteurized mixture is obtained by first homogenizing the second fluid mixture, followed by pasteurization.

While not wishing to be bound by theory, it is believed that the relatively fine dispersion of emulsified fat droplets in this homogenized pasteurized mixture imparts positive textural benefits (e.g., smoother mouthfeel) to the resulting frozen dessert product due to the following effects:

1. The finer fat droplets provide an increased surface area to mass ratio that promotes clumping of the fat droplets and an increased viscosity in the homogenized pasteurized mixture. This increased viscosity promotes more uniform air incorporation during subsequent freezing, thus producing a frozen dessert with more uniform and smaller dispersed air cells.

2. The finer fat droplets help limit ice crystal size during freezing due to steric hindrance effects. A greater number of finer fat droplets interfere with the migration of water molecules to the existing ice crystals, thus causing a greater number of finer ice crystals to form during freezing.

Homogenization of this second mixture can be carried out in the same, or similar fashion, as the homogenization used to obtain the preemulsion. For example, homogenization of the second mixture can be carried out by passing it through either a one-stage, or preferably two-stage, homogenizer. In the case of one-stage homogenizers, suitable operating pressures can be in the range of from about 800 to about 3000 psi, with a preferred range of from about 1500 to 2000 psi. In the case of two-stage homogenizers, the first stage can be operated at a pressure of from about 800 to about 3000 psi (preferably from about 1500 to about 2000) psi, while the second stage is operated at a pressure of from about 500 to about 1000 psi.

Pasteurization can be carried out according to the process of the present invention by any suitable method that is used in pasteurizing conventional frozen dessert products such as ice cream. See Arbuckle, *Ice Cream, supra,* at pages 211-15 (herein incorporated by reference), which describes the pasteurization of conventional ice cream products. For example, pasteurization can be carried out by batch methods (e.g., at a temperature of at least about 155° F. (68.3° C.), for at least about 30 minutes), high temperature short-time methods (e.g., at a temperature of at least about 175° F. (79.4° C.) for at least about 25 seconds), vacreation methods (e.g., at a temperature of at least about 194° F. (90° C.) for from about 1 to about 3 seconds), and ultrahigh temperature methods (e.g., at a temperature of from about 210° to about 265° F. (about 98.9° to about 129.4° C.) for from about 2 to about 40 seconds). The particular pasteurization method and temperature conditions used can alter the flavor characteristics of the mixture, e.g., can impart cooked flavors. Accordingly, the pasteurization method and temperature conditions used needs to be selected with such potential flavor effects in mind.

3. Aging, Adding Flavoring Substances, Freezing, Packaging and Hardening

The homogenized pasteurized mixture is typically rapidly cooled to a temperature of about 40° F. (4.4° C.) or less, and typically to a temperature in the range of from about 32° to about 40° F. (about 0° to about 4.4° C.). The cooled mixture is then typically held in this temperature range for a period of from about 1 to about 12 hours, preferably for from about 1 to about 2 hours, to age the mixture. Aging typically causes the following effects to occur in the mixture: (1) solidification of the fat; (2) swelling and hydration of any stabilizer present, e.g., gelatin; (3) slight changes in the protein present; and (4) increases in the viscosity of the mixture. Aging of the mixture is particularly desirable in terms of improving the textural properties and resistance to melting of the resulting frozen dessert product, as well as ease in incorporating air during subsequent freezing. See Arbuckle, *Ice cream, supra,* at page 222.

The homogenized pasteurized mixture, with or without aging, is then subjected to a freezing step to partially freeze or solidify the mixture. The partial freezing of this homogenized pasteurized mixture can be carried out by any standard freezing method used in the preparation of conventional frozen dessert products such as ice cream. See Arbuckle, *Ice Cream, supra,* at pages 239-66, which is herein incorporated by reference. For example, the homogenized pasteurized mixture of the present invention can be partially frozen or solidified by using a batch freezer, continuous freezer, low temperature continuous freezer, a soft serve-type freezer, or a counter-type freezer. The particular temperature and time conditions for carrying out this partial freezing step can vary greatly depending upon the type of freezer used. For example, the homogenized pasteurized mixtures of the present invention can be partially frozen at temperatures in the range of from about 15° to about 28° F. (about −9.4° to about −2.2° C.) over a period of from about 24 seconds (e.g., continuous or low temperature continuous freezer) to about 10 minutes (e.g., batch or counter freezer). During partial freezing, it is often desirable to agitate, aerate and/or whip the mixture to incorporate air to provide the desired amount of overrun. The particular amount of overrun obtained can be any level appropriate for conventional frozen dessert products, in particular ice cream products.

Flavoring substances (and optionally coloring) can be added to the homogenized pasteurized mixture at any point where such substances are incorporated into conventional frozen dessert products such as ice cream. Typically, flavor extracts, essences and concentrates (e.g., vanilla) are added after the homogenized pasteurized mixture has been aged, but prior to partial freezing. Flavoring substances in the form of whole or comminuted food pieces (e.g., whole or chopped fruit or nuts) are typically added after the homogenized pasteurized mixture has been partially frozen. With these guidelines in mind, no particular criticality is attached to the point at which the flavoring substances are added to the homogenized pasteurized mixture.

After the flavoring substances have been added, the partially frozen mixture can be used as is to provide a soft-serve frozen dessert product. This partially frozen mixture is usually in the form of a semi-solid that is pumpable. To provide a firmer product, this partially frozen mixture is typically poured or pumped into a suitable package or container and then fully hardened. Hardening of this partially frozen mixture can be carried out using standard conditions typically used in the hardening of conventional frozen dessert products, in particular ice cream. See Arbuckle, *Ice Cream, supra,* at pages 270-75, which is herein incorporated by reference. Some typical conditions for hardening partially frozen mixtures of the present invention are temperatures of about −4° F. (−20° C.) or less (typically in the range of from about −10° to about −45° F. (about −23.3° to about −42.8° C.)) for a period of at least about 4 hours (typically for from about 12 to about 24 hours). Such hardening conditions typically provide a frozen dessert product having the firmness of a conventional ice cream product.

D. Analytical Methods for Intermediate Melting Polyol Polyesters

1. Viscosity Measurement

a. Sample Preparation

A sample of the polyesters is melted in a hot water bath at greater than 190° F/ (87.8° C.). The melted sample is thoroughly mixed and 10 grams of melted sample is weighed into a vial. The vial is covered and then heated in a hot water bath to greater than 190° F. (87.8° C.). The sample is then allowed to recrystallize at 100° F. (37.8° C.) in a constant temperature room. After

a 24 hour time period has elapsed, the sample is taken to the viscometer and the viscosity is measured.

b. Ferranti-Shirley Viscometer Operation Procedure

A Ferranti-Shirley viscometer equipped with a 600 g. torque spring is used for the viscosity measurement. A cone is put into place, and the viscometer temperature is adjusted to 100° F. (37.8° C.). The chart recorder is calibrated, and the gap between the cone and plate is set. The cone speed is checked, and the cone and plate temperatures are equilibrated to 100° F. (37.8° C.). The panel controls are set. Sufficient sample is placed between the plate and the cone so that the gap is completely filled. The temperature is allowed to stabilize at 100° F. (37.8° C.) for about 30 seconds. The test is started by selecting the rpm for 10 seconds^{-1} shear rate and record on the strip chart recorder. The shear stress is recorded at 10 minutes after the point at which the shear stress reaches the maximum value. Viscosity (poise)=shear stress (dynes/cm^2) divided by shear rate (second^1).

2. Liquid/Solid Stability Measurement

A sample of the polyesters is heated in a hot water bath a greater than 190° F. (87.8 ° C.) until it completely melts and is then thoroughly mixed. The sample is then poured to capacity into 4.4 ml. centrifuge tubes at 100° F. (37.8° C.). The sample is then allowed to recrystallize for 24 hours at 100° F. (37.8° C.) in a constant temperature room. The sample is then centrifuged at 60,000 rpm in a Beckman Model L870M centrifuge having a Beckman Model SW60head for one hour at 100° F. (37.8° C.). The maximum force on the sample (i.e. at the bottom of the tube) is 485,000 g's. The percent liquid separated is then measured by comparing the relative heights of the liquid and solid phases. Liquid/solid stability (%)=100×(total volume of sample−volume of liquid that separated)/total volume of sample.

3. Solid Fat Content Measurement

Before determining Solid Fat Content (SFC) values, a sample of the polyesters is heated to a temperature of 140° F. (60° C.) or higher for at least 30 minutes or until the sample is completely melted. The melted sample is then tempered as follows: at 32° F. (0° C.) for 15 minutes; at 80° F. (26.7° C.) for 30 minutes; and at 32° F. (0° C.) for 15 minutes. After tempering, the SFC values of the sample at temperatures of 50° F. (10° C.), 70° F. (21.1° C.), 80° F. (26.7° C.), 92° F. (33.3° C.) and 98.6° F. (37° C.) can be determined by pulsed nuclear magnetic resonance (PNMR) after equilibration for 30 minutes at each temperature. The method for determining SFC values by PNMR is described in Madison and Hill, *J. Amer. Oil Chem. Soc.*, Vol. 55 (1978), pp. 328–31 (herein incorporated by reference). Measurement of SFC by PNMR is also described in A.O.C.S. Official Method Cd. 16–81, *Official Methods and Recommended Practices of The American Oil Chemists Society*, 3rd. Ed., 1987 (herein incorporated by reference).

4. Fatty Acid Composition and Trans Fatty Acids

The fatty acid composition (FAC) of the polyesters is determined by gas chromatography, using a Hewlett-Packard Model S712A gas chromatograph equipped with a thermal conductivity detector and a Hewlett-Packard Model 7671A automatic sampler. The chromatographic method used is described in *Official Methods and Recommended Practices of the American Oil Chemists Society*, 3rd Ed., 1984, Procedure Ce 1–62.

The percentage of trans fatty acids in the polyester sample is determined by infrared spectrophotometry (IR). The IR method used is described in Madison et al, "Accurate Determination of trans Isomers in Shortenings and Edible Oils by Infrared Spectrophotometry." *J. Am. Oil Chem., Vol.* 59, No. 4 (1982), pp. 178–81. The trans value obtained by IR, together with the total number of double bonds based on the FAC of the polyester sample, is used to calculate the percentage of trans double bonds.

5. Ester Distribution

The relative distribution of the individual octa-, hepta-, hexa- and penta- esters, as well as collectively the tetra- through mono- esters, of the polyesters can be determined using normal-phase high performance liquid chromatograph (HPLC). A silica gel-packed column is used in this method to separate the polyester sample into the respective ester groupings noted above. Hexane and methyl-t-butyl ether are used as the mobile phase solvents. The ester groupings are quantitated using a mass detector (i.e., an evaporative light scattering detector). The detector response is measured and then normalized to 100%. The individual ester groups are expressed as a relative percentage.

Specific Illustrations of the Preparation of Ice Cream-Like Products of the Present Invention

The following are specific illustrations of ice cream-like products prepared according to the present invention:

EXAMPLE 1

The following ingredients are used in preparing a french vanilla-flavored ice cream-like product:

Ingredient	wt. %
Premulsion	
Condensed skim milk (32% total solids)	52.62
Intermediate melting polyol polyesters	44.90
Polysorbate 60	0.27
DiMODAN O	0.27
Carrageenan	0.07
Dry sucrose	1.87
	100.00
Total Composition	
Premulsion	21.38
Fluid milk (3.4% fat)	32.00
Cream (40% fat)	11.75
Liquid sugar	14.93
Water	9.23
Sweetened whole condensed milk (8% fat)	4.98
Corn syrup (62 D.E.)	2.98
Frozen 10% sugared egg yolks	1.49
Dry sucrose	0.60
Gelatin	0.20
Vanilla	0.40
Color	0.04
	100.00

The intermediate melting polyol polyesters are a sucrose polyester composition made by esterifying sucrose with a mixture of methyl esters derived from a 70/30 blend of partially hardened soybean oil (I.V. 80 to 85) and fully hydrogenated soybean oil (I.V. 1–8). This composition has the following physical and chemical properties:

Viscosity (100° F., 37.8° C.)	33.0 poise
Liquid/Solid Stability (100° F., 37.8° C.)	95%
SFC (98.6° F., 37° C.)	10.4%
I.V.	41.2

-continued

FAC	
C16:0	10.8%
C17:0	0.2%
C16:1	0.0%
C18:0	47.7%
C18:1	33.0%
C18:2	7.2%
C18:3	0.0%
C20:0	0.3%
C20:1	0.1%
C22:0	0.1%
C24:0	0.2%
Trans-fatty acids	13.6%
Percent trans double bonds	28.6%
Esters	
Octa	92.8%
Hepta	7.2%

In forming the preemulsion, the intermediate melting polyol polyesters are weighed into a batch tank. The condensed skim milk is formed by slurrying a mixture of nonfat dry milk and water in a liquefier and then adding it to the batch tank. The DIMODAN O and polysorbate 60 emulsifiers are then added to the batch tank. A slurry of the sucrose and carrageenan stabilizer (blended for 5 minutes in a 20-quart) Hobart mixer) is then added to the batch tank. The ingredients in the batch tank are mixed together and heated to 175° F. (79.4° C.), and then passed through a two-stage homogenizer operated at a pressure of 1700 psi in the first stage and 500 psi in the second stage. The preemulsion obtained is then cooled to a temperature of about 40° F. (4.4° C.) or less.

A second mixture of ingredients is formed by adding the fluid milk, cream, liquid sugar, water, sweetened whole condensed milk, preemulsion, corn syrup, egg yolks, and a blend of sucrose and gelatin (premixed for 5 minutes in a 20-quart Hobart mixer), to a mix tank in the order indicated. The contents of the mix tank are mixed together and heated to a temperature of from 145° to 150° F. (62.8° to 65.6° C.), and then passed through a two-stage homogenizer operated at a pressure of 1700 psi in the first stage and 500 psi in the second stage. This homogenized mixture is then pasteurized at 175° F. (79.4° C.) for three minutes. This homogenized pasteurized mixture is cooled to a temperature of approximately 40° F. (4.4° C.), and then aged at this cooler temperature for 1 to 2 hours. Vanilla flavor and coloring is added to the aged mixture. The flavored and colored mixture is frozen while incorporating air to 100% overrun at 22°-23° F. (−5.6° to −5.0° C.) for 26-36 seconds in a continuous freezer to provide an aerated semi-solid, pumpable mixture which is filled into containers and then fully hardened at −40° F. (−40° C.) for 16 hours to provide a firm product.

EXAMPLE 2

The following ingredients are used in preparing a french vanilla-flavored ice cream-like product:

Ingredient	wt. %
Preemulsion	
Condensed skim milk (32% total solids)	56.87
Intermediate melting polyol polyesters	40.44
Polysorbate 60	0.29
DIMODAN O	0.29
Carrageenan	0.08
Dry sucrose	2.03

-continued

Ingredient	wt. %
	100.00
Total Composition	
Preemulsion	19.78
Milk (3.4% fat)	24.89
Cream (40% fat)	15.83
Liquid sugar	14.93
Water	13.86
Sweetened whole condensed milk (8% fat)	4.98
Corn syrup (62 D.E.)	2.99
10% sugared egg yolks	1.49
Dry sucrose	0.60
Gelatin	0.20
Vitamin E	0.01
Vanilla	0.40
Color	0.04
	100.00

The intermediate melting polyol polyesters are a sucrose polyester composition made by esterifying sucrose with a mixture of methyl esters derived from a 45/55 blend of touch-hardened soybean oil (I.V. 107) and fully hydrogenated soybean oil (I.V. 8). This composition has the following physical and chemical properties:

Viscosity (100° F., 37.8° C.)	42.9 poise
Liquid/Solid Stability (100° F., 37.8° C.)	100%
SFC (98.6° F., 37° C.)	12.6%
I.V.	46.5
FAC	
C16:0	9.6%
C18:0	52.7%
C18:1	21.3%
C18:2	14.7%
C18:3	1.0%
C20:0	0.5%
C22:0	0.2%
Esters	
Octa	82.1%
Hepta	17.9%

In forming the preemulsion, condensed skim milk, intermediate melting polyol polyesters, polysorbate 60 and DIMODAN O emulsifiers, and a premixed blend of carrageenan stabilizer and sucrose is added to a kettle. The contents of the kettle are mixed together and heated to a temperature of 160° F. (71.1° C.), held at this temperature for 30 minutes and then passed through a two-stage homogenizer operated at a pressure of 1700 psi in the first stage and 500 psi in the second stage. The preemulsion obtained is cooled to a temperature of 40° F. (4.4° C.) or less.

A second mixture of ingredients is formed by adding the milk, cream, water, sweetened whole condensed milk, preemulsion, corn syrup, egg yolks, vitamin E, and a premixed blend of sucrose, gelatin and liquid sugar, to a mix tank in the order indicated. The contents of the mix tank are mixed together and preheated to a temperature of 100°-110° F. (37.8°-43.3° C.). This preheated mixture is raised to a temperature of 145°-150° F. (62.8°-65.6° C.) and then passed through a two-stage homogenizer operated at a pressure of 1700 psi in the first stage and 500 psi in the second stage. The homogenized mixture is then pasteurized at a temperature of 175°-180° F. (79.4°-82.2° C.) for a period of approximately 30 seconds. The homogenized pasteurized mix-

ture is cooled to a temperature of approximately 40° F. (4.4° C.) and then aged at this cooler temperature for a period of 1–2 hours. Vanilla flavoring and coloring is added to the aged mixture. The flavored and colored mixture is frozen while incorporating air to 100% overrun at 22°–23° F. (−5.6° to −5° C.) for 26–36 seconds in a continuous freezer to provide an aerated, semisolid, pumpable mixture which is filled into cartons and then fully hardened at −40° F. (−40° C.) for 16 hours to provide a firm product.

What is claimed is:

1. A process for preparing a low calorie frozen dessert, which comprises the steps of:

(A) forming a mixture consisting essentially of:

(1) from about 30 to about 50% fat comprising from about 70 to 100% of edible, wholly or partially nondigestible intermediate melting polyol fatty acid polyesters having at least 4 fatty acid ester groups, wherein the polyol contains at least 4 hydroxy groups and wherein each fatty acid group has from 2 to 24 carbon atoms, the polyol polyesters further having:

(a) a viscosity of from about 2.5 to about 200 poise at 100° F. (34.8° C.) and at a shear rate of 10 seconds^{-1}; and

(b) a liquid/solid stability of at least about 30% at 100° F. (37.8° C.);

(2) from about 10 to about 30% milk solids other than fat;

(3) from 0 to about 10% of a sweetener;

(4) from 0 to about 3% of a stabilizer;

(5) an effective amount of an oil-in-water emulsifier;

(6) from about 25 to about 45% water;

(B) passing the mixture of step (A) through a homogenizer such that a stable oil-in-water preemulsion is formed wherein the fat is substantially homogeneously dispersed in the aqueous phase as emulsified fat droplets;

(C) forming a second mixture comprising:

(1) from about 10 to about 30% of the preemulsion of step (B),

(2) from 0 to about 15% added triglyceride fat;

(3) from about 2 to about 14% added milk solids other than fat,

(4) from 0 to about 20% added sweetener,

(5) from about 36.5 to about 73.5% added water,

(6) the combined amount of components (1) and (2) being sufficient to provide from about 2 to about 20% total fat,

(7) the combined amount of components (1) and (3) being sufficient to provide from about 3 to about 15% total milk solids other than fat,

(8) the combined amount of components (1) and (4) being sufficient to provide an effective amount of sweetener, and

(9) the combined amount of components (1) and (5) being sufficient to provide from about 50 to about 75% total water;

(D) passing the second mixture of step (C) through a homogenizer and pasteurizer such that a homogenized pasteurized mixture is obtained wherein the fat is substantially homogeneously dispersed in the aqueous phase as emulsified fat droplets having an average droplet size of from about 5 microns or less; and

(E) at least partially freezing the homogenized pasteurized mixture of step (D) to provide the frozen dessert product.

2. The process of claim 1 wherein the preemulsion of step (A) consists essentially of:

(a) from about 35 to about 45% fat comprising from about 90 to 100% of the polyol polyesters;

(b) from about 13 to about 24% milk solids other than fat;

(c) from about 1 to about 5% nutritive carbohydrate sweetener;

(d) from about 0.05 to about 2% of the stabilizer;

(e) from about 0.3 to about 0.8% of an emulsifier selected from the group consisting of monoglycerides of C_{16}–C_{18} fatty acids, polyoxyethylene (20) sorbitan monostearate, polyoxyethylene (20) sorbitan tristearate, polyoxyethylene (20) sorbitan mono-olease and mixtures thereof;

(f) from about 30 to about 40% water.

3. The process of claim 2 wherein the polyol polyesters are at least about 70% nondigestible and have a viscosity of from about 5 to about 100 poise, a liquid/solid stability of at least about 50%, and a Solid Fat Content of about 20% or less at 98.6° F. (37° C.).

4. The process of claim 3 wherein the polyol polyesters have a viscosity of from about 20 to about 60 poise, a liquid/solid stability of at least about 80% and a Solid Fat Content of from about 6 to about 15%.

5. The process of claim 3 wherein the polyol is selected from the group consisting of sugars and sugar alcohols containing from 4 to 8 hydroxy groups and wherein each fatty acid ester group contains from 8 to 22 carbon atoms.

6. The process of claim 5 wherein the polyol polyesters are sucrose fatty acid polyesters having at least about 85% esters selected from the group consisting of octaesters, heptaesters, hexaesters and mixtures thereof.

7. The process of claim 6 wherein the fatty acid ester groups of the sucrose polyesters comprise at least about 70% fatty acids selected from the group consisting of lauric, myristic, palmitic, stearic, $C_{18:1}$, C.18:2 and behenic acids, and mixtures thereof, and wherein the sucrose polyesters comprise at least about 70% octaesters.

8. The process of claim 1 wherein the second mixture of step (E) comprises:

(1) from about 15 to about 25% of the preemulsion of step (A),

(2) from 0 to about 8% added triglyceride fat;

(3) from about 3 to about 6% added milk solids other than fat;

(4) from about 10 to about 20% added nutritive carbohydrate sweetener;

(5) from about 45 to about 55% added water;

(6) the combined amount of components (1) and (2) being sufficient to provide from about 10 to about 20% total fat;

(7) the combined amount of components (1) and (3) being sufficient to provide from about 5 to about 10% total milk solids other than fat;

(8) the combined amount of components (1) and (4) being sufficient to provide from about 10 to about 20% total nutritive sweetener; and

(9) the combined amount of components (1) and (5) being sufficient to provide from about 55 to about 65% total water.

9. The process of claim 8 wherein the preemulsion of step (A) is heated to a temperature of from about 140° to about 190° F. (about 60° to about 87.8° C.) and then passed through a two-stage homogenizer operated at a pressure of from about 1500 to about 2000 psi in the first stage, and a pressure of from about 500 to about 1000 psi

in the second stage during step (B), and wherein the second mixture of step (C) is heated to a temperature of from about 135° to about 160° F. (about 57.2° to about 71.1° C.), and then passed through a two-stage homogenizer operated at a pressure of from about 1500 to about 2000 psi in the first stage and from about 500 to about 1000 psi in the second stage during step (D).

10. The process of claim **9** wherein the emulsified fat droplets of the preemulsion of step (B) have an average droplet size of about 5 microns or less and wherein the emulsified fat droplets of the homogenized pasteurized mixture of step (D) have an average droplet size of about 2 microns or less.

11. The process of claim **9** which comprises the further step of aging the homogenized pasteurized mixture of step (D) at a temperature in the range of from about 32° to about 40° F. (about 0° to about 4.4° C.) for a period of from about 1 to about 12 hours.

12. The process of claim **11** which comprises the further step of adding an effective amount of flavoring substances to the aged mixture.

13. The process of claim **12** wherein the flavored aged mixture is partially frozen during step (E) at a temperature of from about 15° to about 28° F. (about −9.4° to about −2.2° C.) for a period of from about 24 seconds to about 10 minutes.

14. The process of claim **13** wherein the flavored aged mixture is aerated during step (E).

15. The process of claim **13** which comprises the further step of fully hardening the partially frozen aerated mixture of step (E) at a temperature of about −4° F. (−20° C.) or less for a period of at least about 4 hours.

* * * * *

EXHIBIT D

United States Patent Office

3,128,193

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3,128,193

METHOD OF FREEZING A LOW FAT FROZEN DESSERT

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4 Claims. (Cl. 99—136)

The present invention relates to an improved frozen dessert, and, more particularly, it relates to an improved low-fat frozen dessert.

Frozen desserts may be classified into those which include fat and those which are essentially free from fat. Examples of the former are ice cream, ice milk, and sherbet, and an example of the latter is a water ice. The present invention is directed toward frozen desserts which include fat, and is directed particularly toward those desserts which include relatively low quantities of fat, such as ice milk. At the present time Federal standards specify that ice milk shall comprise more than 2 percent of fat.

Heretofore, in general, the higher the fat level in a frozen dessert, the more pleasing and appetizing has been its texture and flavor. For example, ice cream, which usually comprises at least about 10 percent of milk fat, has heretofore had texture and flavor superior to the texture and flavor of frozen desserts comprising low proportions of fat.

At the same time, however, the higher the fat content of the frozen dessert, the more costly are the ingredients thereof, and the higher is the calorie content of the frozen dessert. Low fat frozen desserts having desirable texture and flavor characteristics like higher fat content desserts have not been heretofore attainable using conventional techniques.

Accordingly, it is an object of the present invention to provide an improved low-fat frozen dessert and a process of making the same. A more particular object of the present invention is to provide a low-fat frozen dessert which has an improved texture and flavor and a process of making the same. An additional object of the present invention is to provide a low-fat frozen dessert which has improved texture, flavor, and novel thawing characteristics, and a process for making the same. Another object of the present invention is to provide an ice milk which has ice-creamlike texture and flavor, and a process of making the same. Other objects and advantages of the present invention will become apparent from the following description.

Generally, the process of the present invention comprises the steps of preparing a dessert mix which includes between about 2 percent and about 10 percent of an edible fat, and subjecting the mix to intensive internal shear while the mix is cooled to an unusually low temperature. More particularly, the mix is maintained under intensive internal shear until the mix is cooled to a temperature whereat at least about 50 percent of the aqueous component of the mix is present in a crystalline state. The mix is thereafter packaged and hardened to provide the frozen dessert of the present invention.

The frozen dessert of the present invention comprises an aqueous component which is present in a continuous phase, and a fat component present in what appears to be a semi-continuous phase. In this connection, the fat

component is present in the frozen dessert in the form of diffuse filaments, which are to be distinguished from the discrete globules or spheres of fat which are present normally in frozen desserts. This unique form and distribution of the fat component is thought to be responsible, in part, for the novel properties of the frozen dessert of the present invention, as will be more fully set forth hereinafter.

More particularly, in accordance with the present invention, a mix is prepared which comprises an aqueous component and a fat component. The fat component comprises less than about 10 percent of the mix, and may be any edible fat which is firm but spreadable at room temperature, such as milk fat and/or margarine fat. While a mix comprising more than about 10 percent of fat may be processed in accordance with the present invention, the texture and flavor of the frozen dessert so obtained are not as desirable as the texture and flavor of a frozen dessert made with lower levels of fat. On the other hand, the fat component should comprise at least about 2 percent of the mix in order to enjoy the benefits of the present invention.

The aqueous component will ordinarily comprise water, protein, and sweetening agents, and may also comprise stabilizers and flavoring ingredients. It should be pointed out that the mix may be any mix suitable for the preparation of low-fat frozen desserts heretofore known, such as ice milk mix, and that various mix compositions may be utilized, provided, of course, that the fat component comprises less than about 10 percent and more than about 2 percent of the mix.

The above-described mix is introduced into a heat exchanger for cooling thereof. It is important, in the practice of the present invention, that means be provided for subjecting the mix to intensive shear during the freezing step. One apparatus suitable for the practice of the present invention is a modified Votator heat exchanger.

The heat exchanger comprises one or more cylinders through which the mix is passed. A refrigerant is circulated outside the cylinder for cooling of the mix through the cylinder walls. A rapidly revolving axial shaft or mutator is provided in the cylinder, which mutator includes a plurality of radially-extending blades. The blades sweep the walls of the cylinder, to continuously expose a fresh heat exchange surface to the dessert mix contained therein, whereby there is obtained effective heat transfer from the mix to the refrigerant.

In order to effectively carry out the conditions of the process of this invention, the mutator is eccentrically disposed, whereby the mutator and its blades subject the mix to intensive shear, which increases as the mix becomes increasingly viscous with reduction in temperature. It should be pointed out, however, that apparatus other than that particularly described may also be utilized in the practice of the present invention, provided, of course, that the mix is subjected to intensive shear during the cooling step.

The mix is passed through the heat exchanger at a rate whereby the mix is discharged therefrom at a temperature whereat at least about 50 percent of the aqueous component of the mix is present in a crystalline state. This temperature is a function of the composition of the aqueous component of the dessert mix, and, in general, this temperature will decrease as the level of solutes in

the aqueous component is increased. The time required to attain this temperature is dependent upon the temperature of the refrigerant, the temperature at which the mix enters the heat exchanger, and the efficiency of heat transfer from the mix to the refrigerant. However, the temperature where this condition exists is substantially below the temperature at which ice cream and ice milk are normally discharged from a heat exchanger. In this connection, ice cream and ice milk are normally discharged at temperatures at which less than about 45 percent of the aqueous phase is crystallized. In general, the temperature of discharge in accordance with the present invention will be below about 18° F. and will usually be below 17° F.

The mix is packaged and hardened after discharge from the heat exchanger to provide the low-fat frozen dessert of the present invention. As pointed out hereinbefore, the frozen dessert has texture and flavor which is superior to prior art frozen desserts having equivalent fat levels. In addition, the frozen dessert has unique and unexpected thawing characteristics.

In this connection, it is observed that, when exposed to temperatures higher than the normal melting point of the aqueous component, the product of the present invention retains its integrity and shape for extended periods of time. In addition, there is markedly less leakage of liquid from the product at these temperatures than from frozen desserts heretofore known.

For example, when a given mass of the product of the present invention is exposed to room temperature, it is observed that, for a given time of exposure, the rate of release of liquid therefrom is less than about one-half the rate of release of liquid from conventional frozen desserts. In addition, the body and shape of the product of the present invention are retained more than twice as long as with frozen desserts heretofore known.

As a result of the foregoing thawing characteristics, the product of the present invention has the attributes of a "non-melting" frozen dessert. Obviously, however, the product does in fact melt at room temperature, but it is thought that the particular distribution of the fat component, set forth hereinbefore, inhibits leakage of the aqueous component and tends to maintain the integrity and shape of the product.

It is also possible that the improved texture and flavor of the product of the present invention is caused by the particular distribution of the fat component therein. Since the fat component is not distributed as spheres, the surface area of the fat component is substantially increased. Accordingly, the desirable organoleptic properties of the fat component are readily apparent even at relatively low fat levels.

Example I

As an example of the practice of the present invention, an ice milk mix was prepared comprising about 12 percent MSNF, about 10 percent sucrose, about 7.5 percent corn syrup solids, about 4.1 percent butter fat, with the remainder comprising water and various stabilizing agents.

The foregoing ice milk mix was pumped into the first cylinder of a Votator unit at a rate of 185 gallons per hour. The temperature of the mix was 45° F. The first cylinder included a concentric mutator revolving at about 500 r.p.m. The cylinder was cooled with ammonia, and the temperature of the ammonia was about −30° F.

The mix was discharged from the first cylinder at a temperature of about 23.5° F., whereupon the mix was introduced to a second cylinder.

The second cylinder of the Votator unit was provided with an eccentric mutator revolving at about 125 r.p.m. The blades on the mutator were biased against the cylinder walls by biasing means. The mix was subjected to intensive internal shear as the mutator revolved and as the mix was continuously forced at relatively high velocity around the annular space between the mutator and the cylinder walls.

The cooled mix was discharged from the second cylinder at a temperature of about 17.5° F. At this temperature, about 58 percent of the aqueous component of the mix was present in a crystalline state.

The mix was packaged in half gallon cartons, and was hardened in a hardening room at −20° F. to provide a low fat frozen dessert.

The frozen dessert had excellent texture and flavor, and in these respects was considered to be equivalent to a frozen dessert comprising at least about 10 percent milk fat.

The low fat frozen dessert maintained its integrity and shape for extended periods of time upon exposure to room temperature. In this connection, a sample of this frozen dessert and of a control sample prepared from the same mix in accordance with conventional procedures were allowed to stand at room temperature for 45 minutes, and the liquid material which separated from each sample was collected and weighed. At the end of this time, 47 percent by weight of the control sample had separated as liquid, while only 25 percent by weight of the dessert prepared in accordance with the present invention had separated as liquid.

Example II

As a further example of the practice of the present invention, an ice milk mix was prepared which comprised about 13 percent MSNF, about 12 percent sucrose, about 8 percent corn syrup solids, about 2 percent egg albumen solids, and about 4.5 percent butterfat, with the remainder comprising water and various emulsifiers and stabilizers.

The foregoing mix was introduced to the same apparatus as described in Example I. The mix was at a temperature of 45° F., and was introduced at a rate of 305 gallons per hour.

The mix was discharged from the first cylinder at a temperature of 22.5° F., and was discharged from the second cylinder at a temperature of 16° F. At this temperature, about 53 percent of the aqueous component of the mix was present in a crystalline state.

The cooled mix was packaged and hardened as in Example I to provide a low fat frozen dessert. The frozen dessert had excellent texture and flavor, and, in this connection, the frozen dessert was given a market evaluation and in this evaluation it was compared to an ice cream comprising 12 percent milk fat. In the evaluation about fifty percent of those tasting the products preferred the product of this example.

The frozen dessert had thawing characteristics similar to those set forth in Example I.

Thus, there has been provided an improved low-fat frozen dessert and a process of making the same. The product has improved texture and flavor, and also has unique thawing characteristics.

The foregoing description and examples will suggest various modifications in the process and processing equipment to those skilled in the art. Such modifications are deemed to be within the scope of the present invention.

Various of the features of the present invention are set forth in the following claims.

What is claimed is:

1. A method for preparing a low-fat frozen dessert, comprising the steps of preparing a mix comprising an aqueous component and a fat component, the fat component comprising between about 2 percent and 10 percent of the mix, cooling the mix and simultaneously subjecting the mix to intensive shear during said cooling, terminating said cooling and said shear when the mix reaches a temperature whereat between about 50 percent and about 55 percent of the aqueous component of the mix is present in a crystalline state and thereafter freezing and hardening the mix to provide a low fat frozen dessert.

2. A method for preparing a low-fat frozen dessert, comprising the steps of preparing a mix comprising an aqueous component and a fat component, the fat compo-

nent comprising about 4 percent of the mix, cooling the mix and simultaneously subjecting the mix to intensive shear during said cooling, terminating said cooling and said shear when the mix reaches a temperature whereat between about 50 percent and about 55 percent of the aqueous component of the mix is present in a crystalline state, and thereafter freezing and hardening the mix to provide a low fat frozen dessert.

3. A method for preparing a low-fat frozen dessert, comprising the steps of preparing a mix comprising an aqueous component and a fat component, the fat component comprising about 4 percent of the mix, cooling the mix and simultaneously subjecting the mix to intensive shear during said cooling, terminating said cooling and said shear when the mix reaches a temperature whereat about 55 percent of the aqueous component of the mix

is present in a crystalline state, and thereafter freezing and hardening the mix to provide a low fat frozen dessert.

4. An improved low-fat frozen dessert prepared by the method set forth in claim 1.

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EXHIBIT E

United States Patent [19]

Cole et al.

[11] **4,452,824**

[45] **Jun. 5, 1984**

[54] **SOFT, FROZEN DESSERT FORMULATION**

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[21] Appl. No.: **440,694**

[22] Filed: **Nov. 10, 1982**

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 320,168, Nov. 10, 1981, Pat. No. 4,374,154.

[51] **Int. Cl.**³ **A23G 9/02; A23G 9/04**

[52] **U.S. Cl.** **426/565; 426/658**

[58] **Field of Search** 426/565, 566, 567, 658

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Primary Examiner—Jeanette M. Hunter

[57] **ABSTRACT**

A soft frozen dessert product which is readily extruded upon removal from a home freezer and which possesses good textural stability, even after prolonged, freezer storage having a defined, and relatively high, ratio of higher saccharides to mono- and disaccharides and contain sugar alcohol and/or polyhydric alcohol ingredients.

7 Claims, No Drawings

SOFT, FROZEN DESSERT FORMULATION

This application is a continuation-in-part of our co-pending application, Ser. No. 320,168, filed Nov. 10, 1981 now U.S. Pat. No. 4,374,154.

BACKGROUND OF THE INVENTION

This invention provides a new frozen food product, principally for dessert use, that emulates the textural and rheological characteristics of soft serve ice cream while at home freezer temperatures (e.g. 0° F. to 10° F.). The invention embraces a combination of ingredients which define a new frozen dessert product.

Soft serve ice cream, or simply soft serve, is a highly popular dessert with wide appeal. Distinguishing features of conventional soft serve are that it is frozen in a special soft serve freezer, is dispensed by extrusion at carefully chosen subfreezing temperatures and stands up on a cone or dish upon extrusion. Conventional soft serve is usually dispensed at an overrun on the order of 40% to 60%. Although soft serve of this character has been marketed for many years, it is still available only from stores having special freezers that dispense the product for immediate consumption. This is because the product generally is dispensed at temperatures between 16° F. and 24° F. (−9° C. to −6° C.). At lower temperatures, the product is no longer sufficiently soft. Conventional soft serve accordingly is not suited for sale from grocery store freezers for home storage and use. Home freezers maintain temperatures generally around 0° F. to 10° F. (−18° C. to −12° C.) and store freezers, which as used herein includes grocery store, supermarket, and restaurant freezers, are generally at colder temperatures.

Other have expended considerable effort to develop a soft serve product for home use, but apparently without success. U.S. Pat. Nos. 4,244,977 to Kahn, 4,219,581 to Dea et al., 4,145,454 to Dea et al., and 3,993,793 to Finney and U.K. Patent Specification No. 1,508,437 disclose frozen food products which supposedly are softer than usual at freezer temperatures. There is considerable other published art on the subject of frozen desserts, particularly ice cream. A recent text is *Ice Cream*, Second Edition by W. S. Arbuckle, Ph.D., published in 1972 by the Avi Publishing Company, Inc., Westport, Conn.

SUMMARY OF THE INVENTION

This invention relates to a storage-stable frozen dessert product which is sufficiently soft from a home freezer (0° F. to 10° F.) to be extrudable. These products can be dispensed by hand from a collapsible package having an extrusion orifice and, preferably, a mechanism to assist in applying pressure to the product. The products of this invention have a high tolerance to freeze-thaw cycling and are able to be stored for prolonged periods between −10° F. and +10° F. without significant growth of ice crystals. The formulations encompassed within the scope of this invention contain a critical combination of mono-, di-, and polysaccharides to achieve a desirable level of freezer softness and storage stability. The formulations of this invention also include a minor amount of sugar alcohols and/or low-molecular weight polyhydric alcohols which ingredients have also been found to impact upon the softness and stability of the frozen product. Various proteins, fats, emulsifiers, stabilizers and flavor and color agents may also be included in these formulations. All percentages and ratios given in this disclosure (except % overrun) are given as weight percents, unless otherwise indicated.

According to this invention the formulations contain a water level of from about 45% to 63% and a total effective carbohydrate level (including sugar alcohols and polyhydric alcohols) of from about 24% to 34%. The carbohydrates employed in the formulation are selected such that the ratio of higher saccharides to combined mono- and disaccharides and the ratio of disaccharides to monosaccharides fulfill a specific relationship.

When formulating in accordance with this invention, sufficient low molecular weight saccharides are present to depress the freezing point of the formulation several degrees but not sufficient to preclude the formation of ice crystals during product preparation. An absence of ice crystals is undesirable since the product will then not provide the desired and expected coldness impact which the consumer associates with the experience of eating ice cream.

According to this invention, sugar alcohols, such as sorbitol and mannitol, may be included in the formulation at a level of up to 7%. As consumption of sugar alcohols is known to produce an undesirable laxative effect, greater amounts are to be avoided and preferably amounts less than 5% are utilized. When included in the formulations of this invention, sugar alcohols will be tested as being equivalent to an equal weight of monosaccharides for the purpose of calculating saccharide distribution. When employed, sugar alcohols will normally be used at a level of from 1% to 5%, preferably from 3% to 5%.

Further, in accordance with this invention, low-molecular weight (less than 100 M.W.) polyhydric alcohols, such as propylene glycol and glycerol, may be included in the formulation at a level of up to 5%. Polyhydric alcohols are known to function as freezing point depressants and as such will function to impart increased softness to a frozen product. However, as these alcohols tend to have adverse flavor effects and reduce storage stability of the product, large amounts are to be avoided. When included in the formulation of this invention, polyhydric alcohols will be treated for the purpose of calculating saccharide distribution as being equivalent to twice its weight in monosaccharides. When polyhydric alcohols are utilized in the formulations of this invention, they will normally be present at levels of from 1% to 5%, preferably from 2% to 4%.

The term "carbohydrate" as used in this disclosure is meant to include soluble compounds composed of carbon, hydrogen and oxygen in which the latter two elements are in the same proportion as in water as well as functionally equivalent materials such as sugar alcohols and polyhydric alcohols. Thus the term is meant to include sugars (dextrose, fructose, galactose, sucrose, etc.), starch hydrolyzates and the like. Macromolecular carbohydrates, such as natural gums (e.g. locust bean, guar, etc.) which may be incorporated as stabilizers at low levels within the product formulation are not to be included when calculating saccharide distribution in accordance with this invention.

According to this invention, it is possible to formulate soft-from-the-freezer products which possess the organoleptic properties of taste, texture and mouthfeel of conventional soft serve ice cream. The products of this invention have the ability to be extruded as a continuous

ribbon via manual pressure immediately upon removal from a freezer as cold as 0° F. These products will also be tolerant to extended freezer storage of several months and repeated thermal shocks without a significant deterioration of the ice crystal structure. In other words the products of this invention are resistant to the development of large ice crystals during prolonged storage such as would be required for the commercial distribution of the product over large geographical areas and the subsequent storage of the product in the home. Further the normal temperature variations and/or cycling which occur in commercial and household freezer equipment, especially those with frost-free operations, will not destroy the texture of the product.

SOFTNESS METHODOLOGY

The ability of a formulation to be extruded, in the same manner as a soft ice cream, upon removal from a home freezer is judged according to its performance in a standarized extrusion test. According to this test each of the various product formulations were packaged in identical quart-sized, tube-like containers of about 18 inches (45.7 cm) in length which containers have a nozzle-like opening 0.95 inches (2.41 cm) in diameter located at one end and a roller device, adapted to roll-up the tube and force product out through the nozzle, located at the other end of the container. Trained personnel are employed to rate on a scale of 1 to 5, the ease or difficulty of extruding the product from the tube, with a score of one indicating extreme ease of extrusion and a score of five indicating a lack of extrudability leading to rupture of the tube. In all instances the containers of product are removed from 0° F. (−17.7° C.) storage and tempered at 5° F. (−15° C.) for at least eight hours prior to being extruded from the tube.

For purposes of this invention an extrusion score or rating of 2 to 4 is considered to be ideal. An extrusion rating in excess of 4, the nature of the product is such that it can not readily be extruded by hand from a collapsible package at 5° F. At extrusion ratings below 2, the product will be excessively fluid and will not have sufficient body so as to retain its extruded shape or have the ability to stand up in a cone or dish without sagging.

Suitable collapsible packages for the product of this invention could be in the shape of a toothpaste tube wherein the tube is rolled-up to force product out of an extrusion orifice. Alternative packaging could be a flexible pastry bag-type package which can also dispense product in a ribbon form. The product of this invention could also be packaged and marketed in conventional ice cream containers such as cardboard boxes or tubs.

The softness of the soft-frozen product has also been found to be a direct function of the formulation's equilibrium melting temperature (T_m). As will be recognized by those skilled in the art, T_m is a temperature measurable by Differential Scanning Calorimetry (DSC). In the present instance, this measurement was made using a Dupont 990 Thermal Analyzer (available from E. I. Dupont de Nemours & Co., Inc., Wilmington, Del.). T_m is measured as the temperature corresponding to the peak maximum of the melting endotherm for the first-order phase transition of ice to liquid water. The procedure used to measure T_m is as follows. The sample (10 to 25 mg.), in the instrument, is quench-frozen with liquid Nitrogen to −60° C., equilibrated at −60° C. for 5 minutes, then warmed, at 5° C./min., from −60° C. to +40° C. Typical T_m's are generally found in the range from −10° C. to 0° C. for most ice cream-like products. For purposes of this invention, product T_m's should be less than −3° C., preferably less than −4° C. In order to avoid excessive softness, T_m's should be in excess of −10° C., preferably above −8° C.

STABILITY METHODOLOGY

It is well-known that extended freezer storage and temperature cycling of ice-cream/ice-milk products have an adverse effect on the texture of the products. Specifically, the ice crystal structure of the products undergoes changes as evidenced by the growth of ice crystals. The presence of large ice crystals will cause the product to be perceived organoleptically as having an icy texture. A two-week storage study test was employed as a predictive test for assessing the long-term storage stability of the products of this invention.

According to this test, plastic bowls (16 fl. oz. or 473 ml.) were filled with product exiting the ice cream freezer. The bowls are then covered and placed in a hardening room for at least 24 hours. Thereafter the bowls are stored in a freezer having only a single shelf for a period of two weeks. Over each 24-hour period the freezer temperature (normally at 0° F.) is cycled once (or twice) such that the core temperature of the product is raised to a temperature of 20° F. (−6.7° C.).

The stability of the product is assessed by evaluating products which have undergone the aforementioned, two-week, temperature cycling procedure and comparable products which have been stored for a two week period at a constant −5° F. (−20.6° C.). Each sample is given an organoleptic texture rating by a panel consisting of at least three skilled tasters. The rating is on a scale of 0 to 10, with a rating of 0 indicating no perceived iciness (i.e. comparable to fresh high grade ice cream), a rating of 5 indicates a product having moderate sized ice crystals and borderline organoleptic acceptability, and a rating of 10 indicates the presence of large ice crystals and an unacceptable product.

PROCESSING

The products of this invention can be prepared using conventional ice cream technology. A suitable method for preparing the product of this invention comprises adding milk and cream to a steam-jacketed vat which is then brought to 90° F. (32.2° C.). Thereafter, milk solids are dissolved in the heated fluid and then the remaining ingredients are added. Preferably the emulsifiers and stabilizers are dry mixed with a small portion of a sugar component prior to being added to the vat. The mix is then pasteurized by holding at a temperature of 160° F. (71.1° C.) for thirty minutes.

The mix is then passed through a homogenizer of the typical dairy type. Although homogenization may be accomplished in one stage, it is carried out in two stages for best results. Typically, the pressure during the first stage is maintained at about 2,000 psi and the pressure during the second stage is maintained at about 500 psi. The mix is then aged at a temperature of about 40° F. (4.4° C.) for from 4 to 24 hours and then passed through an ice cream freezer where air or an inert gas is incorporated into the product which is cooled and extruded at sub-freezing temperatures of about 20° F. (−6.7° C.) and thereafter stored in a hardening room at about −15° F. (−26.1° C.) or below.

The product can be whipped to any desirable overrun but usually will be within the range of 50–200%, preferably about 75–150%. Although greater than 200%

overrun can be used such products have been found to be very slow-melting and lacking in coldness perception, probably due to the large amount of air which acts to insulate the product. High overrun products may also necessitate extra stabilization. Overruns below 50% are also possible if a more dense product is desired. It should also be noted with respect to overrun that, if the product is to be dispensed from an extruder-type package, an amount of overrun will be lost during the extrusion operation.

PRODUCT FORMULATION

The soft frozen dessert products of this invention are made with well-known food ingredients which provide the fat, protein, water and flavor constituents common in frozen desserts. The amount and exact character of each ingredient will depend upon such factors as the character of the other ingredients and the desired nature of the end product. The ingredients are now further described as to their functionality, type and levels.

The fat constituent aids in providing a creamy taste and the eating characteristics associated with ice cream-like desserts. It also contributes to the smoothness, the body and melting resistance of the frozen dessert. The amount of fat in the product is generally in the range of 2% to 15% by weight of the product. The exact amount of fat is not critical, although the amounts of other ingredients generally are to be adjusted as the amount of fat is changed. Dairy cream and milk are the preferred fat sources; however, other edible fats and oils will be suitable, provided they have unobjectionable taste. Different fats can be used alone or in combination with one another, including the combination of vegetable fats with milk fat. Vegetable oils and fats which may be used include cottonseed oil, soybean oil, corn oil, sunflower oil, palm oil, palm kernel oil, peanut oil, rice oil, safflower oil and coconut oil; and they may be partially or substantially hydrogenated.

A specific function of protein in the new dessert product concerns the attainment of overrun. A formulation with insufficient protein does not whip well and hence is considered deficient in holding the desired overrun. An excessive protein constituent, in contrast, results in a mixture that is unduly thick and does not process well with conventional equipment. The preferred source of the protein constituent of the new dessert product is milk solids not fat (MSNF). Milk solids not fat as used in the preferred compositions of this invention aid in providing the desirable properties of whipping ability, smoothness, body, mouthfeel, melt resistance, lowering of freezing point, and some sweetness. The MSNF can be derived from cream, milk (including condensed milk, skim milk, and condensed skim milk), and non-fat dry milk, or solely from non-fat dry milk solids. Buttermilk can also be used for a portion of the MSNF. Other protein sources with which the invention can be practiced, generally as substitution for a portion of the MSNF, include milk derived solids such as sweet dairy whey, neutralized acid whey, modified whey, whey protein concentrate, casein, modified casein, sodium caseinate, and calcium caseinate; and further include soy flour, modified soy flour, soy protein concentrate, soy isolate, egg protein (yolk and/or white), peanut flour, and peanut protein concentrate. The protein constituent generally accounts for 2% to 10% by weight of the new dessert.

Water is present in the new dessert product as a dispersion medium for the other ingredients of the emulsified product. The portion of water in the product which remains unfrozen provides fluidity for the product. The portion of water which does freeze forms ice crystals that give the product rigidity as well as the refreshing taste perception characteristic of a frozen dessert. An excessive water level is understood to affect adversely the rheological properties of the product. An insufficient water level also affects adversely the desired rheological and organoleptic properties. The water content of the formulations of this invention generally constitutes from 45% to 65% by weight of the product, including the water present in other ingredients, e.g. milk and cream.

The carbohydrate constituent of the new soft frozen dessert is a combination of saccharides and equivalent materials that provides simultaneous control of freezing point depression, sweetness, body and texture, and storage stability. The combination of saccharides which the invention provides depresses the product freezing point for the desired extrudability and softness. Too much saccharide or an unsuitable saccharide combination can cause the product to be too soft, too sweet, or to be highly susceptible to ice crystal growth. An insufficient saccharide level can allow an excessive proportion of water to freeze, with the result that the product does not extrude satisfactorily at the relatively low temperature of interest. As previously noted the total effective carbohydrate level (from all sources, except stabilizers) present in the products of this invention is from 24% to 34%. The preferred distribution of saccharides within the carbohydrate constituent will be further discussed below.

A stabilizer constituent may also contribute to the attainment of the desired performance features of the new in-home dessert. Stabilizers may be used to improve the ability of the product to withstand commercial shelf life and substantial heat shock without undue deterioration, such as a loss of overrun. The stabilizer may include vegetable or synthetic gums and typically includes a combination of gums. Carrageenans, guar gum, locust bean gum, alginates, xanthan gum and the like, gelatin, cellulose gums (e.g. methylcellulose) and micro-crystalline cellulose would be suitable for use in this invention. The amount of these stabilizers can vary widely, but generally will be from 0 to 2%, typically from 0.1 to 0.6%.

An emulsifier constituent is desirable for the practice of this invention and would be necessary when vegetable fats are included in the product formulation. A wide variety of emulsifiers may be employed, typically in amounts of from 0.2 to 1.0%. A suitable emulsifier system for use in this invention is a combination of mono- and diglycerides and polysorbate 80.

The flavoring constituent of the new soft serve dessert is selected from known flavoring ingredients according to the desired taste, taking into account the other ingredients. This constituent includes, by way of illustration, vanilla, vanilla extract, cocoa, fruits, nuts, and the like as well as other flavorings, both natural and artificial. Note, however, that the ingredient ranges specified herein, unless stated otherwise, are for an unflavored product. Those skilled in the art will comprehend the adjustments appropriate for the particular flavoring used.

According to this invention the sweetness of the product can be adjusted to meet any desired level by the use of known food ingredients. The products can be formulated to be free of either intensive sweeteners,

such as saccharin or aspartame, or sweetness depressants such as quinine, theobromine, caffeine or marinegen; however, the use of such additives to adjust sweetness levels to particular tastes is within the scope of this invention. The specific operative examples set forth in this disclosure represent products that achieve conventional levels of sweetness without the utilization of these additives.

SACCHARIDE DISTRIBUTION

A series of formulations, as set forth in Table 1, were prepared in order to assess the effect of various saccharide distributions, including the presence and absence of uated for extrudability at 5° F., T_m and iciness after two weeks of temperature cycling, in accordance with the methodologies noted previously.

Two numerical parameters (Ratio 1 and Ratio 2) which quantify the respective saccharide distributions, are also obtained. Ratio 1 refers to the ratio of higher saccharides (3 or more saccharide units) to mono and disaccharides and Ratio 2 refers to the ratio of disaccharides to monosaccharides. The results are set forth in Tables 2 and 3 which also include formulas representing Example 1 of U.S. Pat. No. 4,219,581 to Dea, the Example of U.S. Pat. No. 4,244,977 to Kahn et al., and Example 1 of U.S. Pat. No. 4,346,120 to Morley et al.

TABLE 1

Run #	Whole Milk	Cream	NFDMS	Corn Syrup Solids (36 DE) (80% solids)	Corn Syrup (50 DE) 81% solids	HFCS (71% solids)	Dextrose (8.5% H_2O)	Sucrose	Sorbitol	Glycerol (1% H_2O)
89	40.84	25.07	6.24	16.85	—	—	10.44	—	—	—
90	43.11	23.78	6.16	16.85	—	—	—	—	9.55	—
91	42.98	23.79	6.16	16.85	—	—	—	—	—	9.66
92	48.81	23.29	5.67	16.85	—	—	—	—	—	4.83
93	56.86	7.59	7.87	10.39	4.26	7.29	—	5.18	—	—
94	59.32	7.38	7.68	10.39	4.26	—	—	5.18	—	5.25
95	62.49	7.11	7.4	10.39	4.26	—	—	5.18	—	2.62
85	59.61	7.36	7.65	10.39	—	—	9.48	5.18	—	—
87	60.47	7.28	7.58	10.39	—	—	—	5.18	—	8.77
88	65.75	6.83	7.13	10.39	—	—	—	5.18	—	4.38

TABLE 2

Run #	Fructose	Dextrose	Sorbitol	Glycerol	Effective Total Monosaccharides	Sucrose	Lactose (as 50% NFMS)	Maltose	Total Di-saccharides	Higher Saccharides
89	0	11.45	0	0	11.45	0	5.5	1.58	7.08	10.00
90	0	1.90	9.55	0	11.45	0	5.5	1.58	7.08	10.00
91	0	1.90	0	9.55	21.00	0	5.5	1.58	7.08	10.00
92	0	1.90	0	4.78	11.45	0	5.5	1.58	7.08	10.00
93	2.17	4.03	0	0	6.21	5.18	6.5	2.64	14.32	8.07
94	0	1.45	0	5.20	11.85	5.18	6.5	2.49	14.17	7.82
95	0	1.45	0	2.60	6.65	5.18	6.5	2.49	14.17	7.82
85	0	9.85	0	0	9.85	5.18	6.5	0.97	12.65	6.17
87	0	1.17	0	8.67	18.51	5.18	6.5	0.97	12.65	6.17
88	0	1.17	0	4.33	9.83	5.18	6.5	0.97	12.65	6.17
Morley et al	3	1.12	10.8	0	14.92	0	5.5	0.72	6.2	7.14
Dea et al	0	0.39	0	5.0	10.39	14.12	5.60*	0.34	20.06	1.52
Kahn et al	19.35	2.15	0	0	21.45	0.7	5.90	0	6.6	0

*whey considered as 80% lactose

TABLE 3

Run #	Ratio 1	Ratio 2	(28 × Ratio 1) + (Ratio 2)	(80 × Ratio 1 + (3 × Ratio 2)	T_m (°C.)	Extrusion Rating	Iciness Rating (Controlled storage)	Iciness Rating (Cycled storage)
89	0.54	0.62	15.74	45.06	−5.0	3.3	0.4	1.4 (3.0)*
90	0.54	0.62	15.74	45.06	−4.5	3.8	0.5	1.5
91	0.36	0.34	10.42	29.82	−6.5	1.0	2.9	6.5
92	0.54	0.62	15.74	45.06	−4.0	3.3	0	2.8
93	0.39	2.31	13.23	38.13	−4.0	3.3	0.5	2.8 (3.0)*
94	0.30	1.20	9.60	27.60	−5.0	1.7	2.1	5.3
95	0.38	1.12	12.76	36.76	−3.5	4.0	1.3	4.8
85	0.27	1.28	8.84	25.44	−4.5	3.2	0	2.9 (5.0)*
87	0.20	0.68	6.28	18.04	−6.5	1.0	3.1	8.3
88	0.27	1.28	8.84	25.44	−4.5	2.2	1.8	6.5
Morley et al	0.34	0.42	9.94	28.46	<4.0	<4.0	—	<4.0
Dea et al	0.05	1.93	3.33	9.63	<3.0	<4.0	—	8.0*
Kahn et al	0	0.31	0.31	0.93	<5.5	<4.0	—	7.0*

*Iciness rating with two cycles per 24 hour period

any sugar alcohols or polyhydric alcohols, which components are treated as saccharides in the manner previously noted. These formulas contained a constant emulsifier system of mono- and diglycerides and polysorbate 80 at a level of 0.43% for runs 89 to 95 and 0.22% for runs 85 to 88 and a constant stabilizer system consisting of sodium alginate at 0.1% (includes 50% carrier) and kappa carrageenan at 0.02%. These formulas were evaluated for extrudability at 5° F., T_m and iciness after two weeks of temperature cycling, in accordance with the methodologies noted previously.

An analysis of the formulations and properties of the products identified in Table 2 as well as numerous other formulations on which softness and/or storage stability data have been obtained, has led to the identification of a defined numerical relationship for Ratio 1 and Ratio 2 values. Fomulations which satisfy this relationship function well as soft ice cream desserts in that they are ex-

trudable from a collapsible package upon removal from a home freezer, have a pleasant level of sweetness, and have a high level of storage stability such that the product may be kept in a no-frost home freezer for several weeks, without the development of undesirable iciness.

The desired relationship is such that the sum of Ratio 2 and 28 times Ratio 1 has a numerical value of from 11 to 28. This relationship may be expressed in equation form as follows:

$$11 \leqq (28 \times \text{Ratio } 1) + \text{Ratio } 2 \leqq 28.$$

A more preferred relationship for the formulations of this invention satisfy the following equation:

$$35 \leqq (80 \times \text{Ratio } 1) + (3 \times \text{Ratio } 2) \leqq 64.$$

According to highly preferred embodiments of this invention, Ratio 1 has a value of from 0.36 to 0.70.

Having thus described the invention, what is claimed is:

1. A frozen, aerated dessert product which can be extruded by hand from a collapsible package at temperatures between 0° F. and 10° F., said product having an equilibrium melting temperature (T_m) between −3° C. and −10° C. and said product having a water content of from 45% to 63% by weight, a fat content of from 2% to 15% by weight, a protein content of from 2% to 10% by weight and a total carbohydrate level of from 24% to 34%, said carbohydrate level including an amount of sugar alcohols up to 7% by weight and/or polyhydric low-molecular weight alcohols up to 5% by weight, and said carbohydrates being distributed such that the ratio of higher saccharides to mono- and disaccharides (Ratio 1) and the ratio of disaccharides to monosaccharides (Ratio 2) satisfy the relationship of $11 \leqq (28 \times \text{Ratio } 1) + \text{Ratio } 2 \leqq 28$.

2. The product of claim 1 wherein Ratio 1 and Ratio 2 satisfy the relationship $35 \leqq (80 \times \text{Ratio } 1) + (3 \times \text{Ratio } 2) \leqq 64$.

3. The product of claim 2 wherein Ratio 1 is from 0.36 to 0.70.

4. The product of claim 1 wherein the overrun is from 75% to 150%.

5. The product of claim 1 wherein the fat content is between 3.5% and 7%.

6. The product of claim 1 wherein the sugar alcohols are present at a level of from 1% to 5%.

7. The product of claim 1 wherein low-molecular weight polyhydric alcohols are present at a level of from 1% to 5%.

* * * * *

UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 4,452,824

DATED : June 5, 1984

INVENTOR(S) : Bruce A. Cole et al.

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Add to cover page below inventorship:

[73] Assignee: General Foods Corporation
White Plains, New York

Signed and Sealed this

Twenty-sixth Day of *March 1985*

[SEAL]

Attest:

DONALD J. QUIGG

Attesting Officer *Acting Commissioner of Patents and Trademarks*

EXHIBIT F

United States Patent [19]

Morley

[11] **4,427,701**

[45] **Jan. 24, 1984**

[54] **FROZEN YOGURT PRODUCT**

[75] Inventor: **Robert G. Morley**, Stone Mountain, Ga.

[73] Assignee: **Landwide Foods, Inc.**, Dover, Mass.

[21] Appl. No.: **383,767**

[22] Filed: **Jun. 1, 1982**

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 210,846, Nov. 26, 1980, Pat. No. 4,346,120.

[51] Int. Cl.³ **A23G 9/02**; A23G 9/04; A23C 9/123; A23C 9/13

[52] U.S. Cl. 426/36; 426/43; 426/39; 426/565; 426/567; 426/583

[58] Field of Search 426/565, 566, 567, 583, 426/36, 42, 39

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Primary Examiner—Jeanette M. Hunter

Attorney, Agent, or Firm—Lahive & Cockfield

[57] **ABSTRACT**

A frozen yogurt product, which emulates features of conventional soft serve frozen yogurt but at the lower temperatures of home freezers, has a unique composition with multiple stabilizers, multiple emulsifiers, and multiple sugars, is incubated in multiple stages, and is aerated to a selected specific gravity.

18 Claims, 1 Drawing Figure

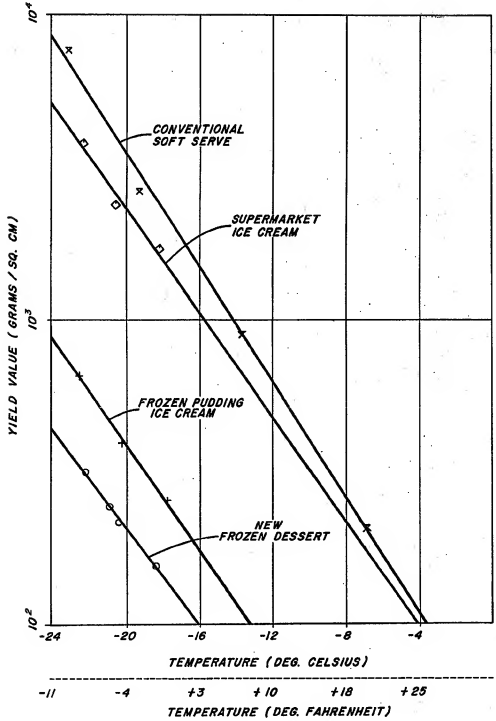
YIELD VALUE (GRAMS / SQ. CM)
10^4
10^3
10^2
CONVENTIONAL SOFT SERVE
SUPERMARKET ICE CREAM
FROZEN PUDDING ICE CREAM
NEW FROZEN DESSERT
-24
-20
-16
-12
-8
-4
TEMPERATURE (DEG. CELSIUS)
-11
-4
+3
+10
+18
+25
TEMPERATURE (DEG. FAHRENHEIT)

FIG. 1

FROZEN YOGURT PRODUCT

REFERENCE TO RELATED APPLICATIONS

This application is a continuation-in-part of co-pending U.S. application Ser. No. 210,846 filed Nov. 26, 1980 now U.S. Pat. No. 4,346,120, entitled "Frozen Dessert Product", and is related to co-pending U.S. applications Ser. Nos. 228,557 now U.S. Pat. Nos. 4,400,406 and 228,550, now U.S. Pat. No. 4,400,405 both filed Jan. 26, 1981, entitled "Frozen Dessert Food" and "Dietetic Frozen Dessert Food", respectively, the disclosures of which are incorporated herein by reference.

BACKGROUND OF THE INVENTION

This invention provides a new frozen food product, principally for dessert use, that emulates the features of conventional soft serve frozen yogurt but at such lower temperatures as to be suitable for prolonged storage in store and home freezers. The invention embraces a composition of ingredients and processing steps which provide the new frozen yogurt product.

Soft serve frozen yogurt is a highly popular dessert with wide appeal. The soft serve industry, of which the soft serve frozen yogurt industry is a part, has grown to such an extent that it is recognized as a distinct segment of the frozen dessert field and encompasses manufacturers and retailers of soft serve products, and suppliers of processing equipment for the product.

Distinguishing features of conventional soft serve frozen yogurt are that it is frozen in a special soft serve freezer, is dispensed by extrusion at carefully chosen sub-freezing temperatures and stands up on a cone or dish upon extrusion. Soft serve frozen yogurt generally is consumed almost immediately after extrusion from the soft serve freezer and hence essentially at the extrusion temperature.

Although soft serve frozen yogurt of this character has been marketed for nearly a decade, it is still available only from stores having special freezers that dispense the product for immediate consumption. This is because the product is dispensed at temperatures between 16° F. and 21° F. (−9° C. to −6° C.). At lower temperatures, the product is no longer soft, but rather it tends to be so hard that it is unsatisfactory for commercial sale. Conventional soft serve frozen yogurt accordingly is not suited for sale from grocery store freezers for home storage and dispensing. Home freezers maintain temperatures generally around 0° F. to 10° F. (−18° C. to −12° C.), and store freezers, which as used herein includes grocery store, supermarket, and restaurant freezers, are generally at colder temperatures.

Although others have expended considerable effort to develop a soft serve product for home use, apparently without success, there is no mention of soft serve frozen yogurt for home use in the prior art. U.S. Pat. Nos. 4,146,652; 4,154,863; 4,199,605; 4,199,604; 4,145,454; and 3,993,793 and U.K. Patent Specification No. 1,508,437 disclose frozen food products which supposedly are softer than usual at freezer temperatures; however, none appears to provide a soft serve-like frozen yogurt product suitable for purchase from a store freezer and storage in a home freezer. There is considerable other published art on the subject of frozen desserts, particularly ice cream. One example of the art is a recent text, *Ice Cream, Second Edition* by W. S. Arbuckle, Ph.D., published in 1972 by the Avi Publishing Company, Inc., Westport, Connecticut.

It is accordingly an object of this invention to provide a soft serve frozen yogurt product suited for home freezer storage.

It is a further object of the invention that the soft serve frozen yogurt product be suited for storage in a home freezer and for dispensing by extrusion directly after removal from that freezer.

The invention accordingly seeks to provide a frozen food product which emulates features of conventional soft serve frozen yogurt but at the significantly lower temperatures standard in home freezers.

It is also an object of the invention to provide a frozen yogurt product of the above character which existing commercial frozen yogurt and qualified frozen food distribution companies can store and distribute at the temperatures of available equipment, generally in the order of 0° F. to −10° F. (−18° C. to −23° C.), with high retention of body, texture, volume, and taste for at least six months.

Other objects of the invention will in part be obvious and will in part appear hereinafter.

The invention accordingly comprises a frozen product possessing the features, the properties, and the relation of components which will be exemplified in the soft serve frozen yogurt product hereinafter described, and the several steps and the relation of such steps with respect to each of the others as exemplified in the process hereinafter set forth. The scope of the invention is indicated in the claims.

BRIEF DESCRIPTION OF DRAWING

For a fuller understanding of the nature and objects of the invention, reference should be made to the following detailed description and the accompanying drawing, which is a graphical representation of yield strength as a function of temperature for a soft serve product related to the soft serve frozen yogurt product of the invention and for three prior dessert products.

THE INVENTION

The features of conventional soft serve frozen yogurt which are important to consumers include the organoleptic properties of taste, after taste, and mouth feel. Many of these are subjective properties and hence not readily measured or quantified. For example, one important taste which has been difficult to attain in a frozen yogurt which is soft enough for extrusion at home freezer temperatures is the absence of a burning sensation. Features of standard soft serve frozen yogurt also include the ability to be extruded and to retain the extrudate shape, the ability to stand up in a cone or dish without sagging, sufficient body strength so as not to slip or fall sideways when the cone or dish tips, and the proper bite resistance so that the consumer can either lick the product or bite and chew it with a satisfactory mouth feel. The soft serve frozen yogurt is to retain all of these properties, in addition to resistance to melting and dripping, for a sufficient time—typically ten minutes at room temperature, e.g., 68° F.—until the serving is eaten.

Other properties of a frozen dessert that is to be sold in a grocery store for home storage and dispensing by extrusion include prolonged storage life without deterioration, whether visible or taste perceptable. The product is also to resist thermal shock, i.e., resist deterioration when subjected to varying temperatures. Tempera-

ture variations occur normally in a freezer as the equipment cycles, especially through frost-free operation. An extreme thermal shock occurs when the product is warmed to a near melting temperature and then re-chilled to a freezer temperature, as can occur during transfer of the product from the store freezer to the home freezer.

Stated more technically, a soft serve frozen yogurt dessert that can be dispensed by extrusion requires deformation and flow properties, i.e., rheological characteristics, that enable the frozen product, when subjected to reasonable extrusion forces, to become sufficiently fluid to flow through the extrusion nozzle. This performance involves the rheological characteristic termed shear thinning. The extruded product, however, must essentially immediately set-up, i.e., lose the shear-responsive fluidity, in order to retain the extrudate shape and to stand up on a cone or dish. Yet the extruded product preferably is sufficiently bondable upon extrusion to be coiled on itself as does conventional soft serve yogurt. These characteristics of the frozen yogurt dessert product may be called coneability. Commercial soft serve frozen yogurt is coneable in that it can be extruded with a rod-like shape and immediately coiled in sequential layers on a cone or dish to provide a spiraled serving that tends to retain its shape.

The attaining of this performance with a product at home freezer temperature requires flow properties different from those of conventional soft serve frozen yogurt. They also are different from those of regular frozen yogurt, which cannot be dispensed by extrusion when at home freezer temperatures, but rather requires, as known, scooping or dipping with a tool.

Properties of the frozen material important to attaining the foregoing extrudability and coneability include yield value at the desired extrusion temperature, viscosity, shear thinning value at the extrusion temperature and shear rate, relaxation time, and lateral resistance.

Yield value is a measure of the material strength and particularly, the resistance to deformation and flow. Yield value is commonly determined from measurements made with a cone penetrometer. A material with too high a yield value is unduly hard, and too low a value means the material is unduly soft. A moderate yield value is desired in order that the product be extrudable with hand pressure. The yield value for the soft serve frozen yogurt disclosed herein at home freezer temperature (about 0° F.) should be no higher than that of conventional soft serve frozen yogurt at extrusion temperature (18° F.).

Shear thinning value determines the rate at which a material flows under particular conditions. It is the relative drop in viscosity of the material when subjected to the shear stress and shear rate which cause extrusion at the specified temperature, with the particular orifice configuration used, and at the desired flow rate. The desired value for this invention yields a sufficient flow to dispense a serving of the frozen yogurt product within a few seconds.

Relaxation time is the time, typically in seconds, for the frozen yogurt product to set up after extrusion at the specified temperature. It is measured as the time required for the yield value of the frozen yogurt to return to 63.2% of its pre-extrusion value after removal of the pressure which induced the extrusion flow. The relaxation time should be sufficiently long to allow successive coiled layers of the extruded frozen yogurt to bond together, but short enough so that a cone of the material can be handled, and even tipped, promptly after being dispensed.

Lateral resistance is the elastic strength of the material to resist deformation. The lateral resistance important in the context of this invention can be measured as the force necessary to bend permanently a cylindrical or other rod-shaped extrudate of the frozen product, with given dimensions, at the extrusion temperature. This lateral resistance hence identifies the ability of an extruded conical serving of the product to maintain the extruded shape, e.g., to resist deflection and bending, and for layers of the product to stand up in tiers.

It has been found that a new soft serve frozen yogurt product can be formulated and prepared which amply satisfies the foregoing objectives and criteria. The product is prepared ready for consumption and packaged for a consumer to purchase from a store freezer. The consumer stores the product in a home freezer, which as used herein includes the freezer section of a home refrigerator, and dispenses the soft serve frozen yogurt product directly from the package for consumption. The product preferably is in a package which can be manipulated to extrude the soft serve frozen yogurt product under hand pressure to yield a serving which is essentially the same in appearance, as well as in taste, as conventional soft serve frozen yogurt dispensed from a soft serve freezer.

The soft serve frozen yogurt product of the invention is formulated with ingredients which provide the protein, water, flavor constituents common in frozen yogurt, yogurt culture, and the optional fat, and further containing unique multi-ingredient sugar, stabilizer and emulsifier systems. The attainment with these ingredients of the fine taste, the pleasing mouth feel, and the exacting rheological properties required for a household soft serve frozen yogurt is deemed unexpected and not predictable.

One particular feature of the invention is a soft serve frozen yogurt that has both unusually low specific gravity and substantial body and chewiness. The formulation of the new product enables it to be whipped with significantly more air than is common for conventional soft serve frozen yogurt and thereby to attain the desired low specific gravity. The ice cream, frozen yogurt and soft serve frozen product industries describe the amount of air in a product as overrun. This term measures the percentage by which the volume of the liquid mix for a product is increased during whipping and freezing. Thus, when one gallon of mix produces two gallons of finished product, the overrun is 100%.

The overrun of the soft serve frozen yogurt product of this invention typically is greater than 100% and can exceed 200%. This is more than twice the overrun normally found in conventional soft serve frozen yogurt (40–60%). It is understood that conventional soft serve frozen yogurt mix cannot take 200% overrun and remain appetizing. By contrast, the new product is highly appetizing. In fact, the body, texture and mouth feel of the new product have been judged to be very acceptable and satisfactory.

Another particular feature of this invention is a soft serve frozen yogurt that is essentially free of "burn". Consumers have identified this perception of a burning sensation on the tongue and in the throat as a serious drawback of products with depressed freezing points. It is believed that the sensation is due to dehydration caused by the additional sugars commonly used as

freezing-point depressants. The prior heavy use of sugars also has caused a cloying sweetness.

The new soft serve frozen yogurt attains significant freezing point depression without a significant burn sensation and without undue sweetness. The invention attains these distinct advantages by combining a unique sugar system with the relatively high overrun.

The ingredients are now described further, beginning with the more common ones. If one of the ingredients is varied, the others may also be varied to achieve optimum results. The optional fat constituent, when present, aids in providing a creamy taste and the eating characteristic associated with yogurt-like products. It also contributes to the smoothness, the body and the melting resistance of the soft serve frozen yogurt. The amount of fat in the product is generally within the range of 0% to 5% by weight of the product. The exact amount of fat is not critical, although the amounts of other ingredients generally are to be adjusted as the amount of fat is changed. The general amount and character of the fat in part relates to the amount of water in which it is emulsified. If too much fat is present, the soft serve frozen yogurt may be unduly firm and unsuitable for home freezer extrusion. The fat constituent typically is provided in the form of triglyceride fats and/or oils, and milk fat and/or butter fat are preferred. Hence dairy cream and milk are preferred fat sources. Other edible fats and oils are believed suitable, provided they have a solid fat index within the level desired for taste and performance. Different fats can be used alone or in combination with one another, including the combination of vegetable fats with milk fat. Vegetable oils and fats which are suitable sources of the edible triglycerides include cottonseed oil, soybean oil, corn oil, sunflower oil, palm oil, palm kernel oil, peanut oil, rice oil, safflower oil and coconut oil; these fats may be partially or substantially hydrogenated.

The protein in the new soft serve frozen yogurt product functions to promote high overrun. If the protein level is too low, the soft serve frozen yogurt does not whip well and fails to hold the desired overrun. If the protein level is too high, the mixture would be unduly thick to process.

The preferred source of the protein constituent of the new dessert product is milk solids not fat (MSNF). Milk solids not fat used in the preferred composition according to the invention aid in providing the desirable properties of whipping ability, smoothness, body, mouth feel, melt resistance, lowering of freezing point, and some sweetness. The lactose or milk sugar present in the MSNF additionally acts as a substrate for the yogurt bacteria to use to produce lactic acid and flavor. The MSNF can be derived from cream, milk and non-fat dry milk, or solely from non-fat dry milk with the addition of water. Buttermilk can also be used for a portion of the MSNF. Other protein sources with which the invention can be practiced, generally as substitution for a portion of the MSNF, include milk derived solids such as sweet dairy whey, neutralized acid whey, modified whey, whey protein concentrate, casein, modified casein, sodium caseinate, and calcium caseinate. The protein constituent generally accounts for 4% to 5.5% by weight of the new dessert, with 4.6–5.2% considered preferable.

The water of the new soft serve frozen yogurt product generally constitutes from 50% to 60% by weight of the product, including the water present in other ingredients, e.g., milk and cream. Water preferably constitutes around 54–58% of the product.

If no flavoring constituent is added, the frozen yogurt mix will yield a plain yogurt flavor. If a different flavor is sought, the flavoring constituent of the new soft serve frozen yogurt is selected from known flavoring ingredients according to the desired taste, taking into account the other ingredients. This constituent includes, by way of illustration, cocoa, fruits, nuts, and the like as well as other flavorings, both natural and artificial. Note, however, that the ingredient ranges specified herein are for an unflavored product and for a product flavored with a concentrate, e.g., vanilla, present in only a small amount by weight. Those skilled in the art will comprehend the adjustments appropriate for the particular flavoring used.

The sugar constituent of the new soft serve frozen yogurt is a combination of saccharides that provides simultaneous control of freezing point depression, sweetness, body and texture, and flavor. The effects in frozen yogurt of added saccharides in contributing to sweetness and in lowering freezing point are known at least in general terms, but the provision of a sugar system that provides a simultaneous blend of organoleptic and material properties required for a household soft serve frozen yogurt is considered to be novel. The added sugar to attain these objectives, i.e., in addition to sugars present in the milk solids and other constituents of the product, is in the range of 22–30%, with 24–28% being preferred. Typically the added sugar plus the sugar in milk solid ingredients constitutes on the order of 31–35% by weight of the product.

The saccharide system of the invention, which as noted is considered important in providing a soft serve frozen yogurt having no significant perception of burn, preferably has fructose, sorbitol and corn syrup as at least the major sugar ingredients. The corn syrup considered preferable is 36 DE (dextrose equivalent), while if a no fat product is made, 24 DE is also added. The sugar system may, however, employ other saccharides, depending at least in part on the subjective properties desired for the final product. Suitable other sugars are sucrose, dextrose, mannitol and fructose corn syrups. It has, for example, been found that dextrose can replace all or part of the sorbitol, but generally a less desirable flavor results, in particular a burning sensation is experienced upon total replacement.

It is understood that sugar systems employing a combination of sorbitol and fructose have heretofore been used in certain diabetic ice creams, which of course have significantly different mechanical properties from a soft serve frozen yogurt. It further is understood, however, that this prior sugar system did not also employ corn syrup, as found in the practice of the present invention. It also is understood that the new soft serve frozen yogurt of this invention employs a significantly larger added sugar constituent than known diabetic ice cream.

The stabilizer constituent of the invention also contributes to the attainment of the desired performance features of the new household dessert. It is selected to improve the ability of the product to withstand commercial shelf life and heat shock without undue deterioration while assisting in the ability of the product to hold the overrun. The stabilizer element contributes to these objectives by providing a combination of stabilization, gelling and blocking functions as well as acting as a protective colloid. The stabilizing constituent of the

invention typically is in the range between 0.5% to 1.1% by weight of the entire product. The amount varies however with factors including the amount of water and the strength of the stabilizers employed. It is hence considered that features of the invention can be realized with a stabilizer constituent within the broader range of 0.25% to 1.5%.

In practice, the stabilizer system employs at least one stabilizer from each of at least three groups of stabilizers, namely insoluble blocking agents, water-binding stabilizing gums, and gelling agents. The blocking agent is present in an amount generally between 0.1% and 1.0% of the total product, preferably 0.25-0.5%. Preferred examples of the insoluble blocking agent are microcrystalline cellulose and cellulose fibers. The stabilizing gum is present in a range generally between 0.07% and 0.3% with 0.12%-0.2% preferable. The gum is selected from a group consisting of locust bean gum, guar gum, propylene glycol alginate, tara gum, sodium carboxymethyl cellulose (CMC), and other cellulose ethers such as methylcellulose, hydroxypropylcellulose and hydroxypropylmethyl cellulose. The gelling agent is present in an amount generally ranging between 0.1% and 0.5%, preferably 0.168%-0.365%, of the total product and is selected from gelatin, xanthan gum, carrageenan, sodium alginate and pectin.

Where it is desired that the product include a wheying-off (syneresis) protective agent, the gelling agent carrageenan can additionally provide this function.

A stabilizer system considered preferable for practice of the invention consists essentially of microcrystalline cellulose, locust bean gum, guar gum, gelatin, hydroxypropylmethyl cellulose and carrageenan. Those skilled in the art will recognize that several of the constituents may perform multiple functions. For example, gelatin can serve both as a stabilizing gum and a gelling agent while carrageenan provides the functions of a gelling agent, a stabilizing gum and as a protective colloid.

The emulsifier constituent of the invention is in most instances present in the range between 0.45% to 0.775% of the total product and employs ingredients from two emulsifier groups. One emulsifier group is a whipping agent, examples of which are mono- and diglycerides, and distilled monoglycerides. The second category of emulsifier is a drying agent, examples of which are polysorbate 80, polysorbate 65, and ethoxylated mono- and diglycerides.

Emulsifier systems found preferable for practice of the invention consist essentially of a combination of mono- and diglycerides and polysorbate 80 with distilled monoglycerides utilized if a non-fat final product is sought.

A yogurt culture consisting essentially of lactobacillus bulgaricus and streptococcus thermophilus organisms is used to inoculate the milk portion of the constituents. In a preferred embodiment, the ratio of the two bacteria strains is 1:1. The inoculation cultures may be freeze dried or frozen concentrated, or another batch of yogurt containing live organisms may be utilized as the inoculation culture. If a freeze dried culture (for example, CH3 from Christian Hansen's Lab, Inc.) is used as an innoculant, approximately 2 gm. of culture per gallon of yogurt portion is needed while 14 gm. of frozen concentrate culture is needed per gallon. If the innoculant is a bulk starter culture, use about 4% by weight.

In addition to the foregoing ingredients, the household soft serve frozen yogurt of the invention can include other ingredients, non-limiting examples being lower chain monohydric and polyhydric alcohols, starches, inorganic salts, and pH buffering agents.

The preparation of the soft serve frozen yogurt according to the invention employs processing equipment conventional for ice cream and frozen yogurt, both hard and conventional soft serve, but as set forth below differs from the overall conventional processing. The milk and other dairy products are combined with the chosen emulsifiers and the mixture is pasteurized to ensure a sterile environment for growth of the yogurt producing organisms. A preferred pasteurization cycle is 30 minutes at 180° F. (82° C.). The sterile mixture is then homogenized while hot to form an oil-in-water emulsion. The homogenization can be carried out in standard two-stage homogenizing equipment. This equipment is preferably operated with an homogenization pressure in the first stage on the order of 2,000 psi and a second stage pressure on the order of 500 psi. These pressures, however, are not considered critical, and other homogenizing pressures can be used.

The sterile mixture is then cooled to incubation temperature and innoculated with the yogurt culture. The incubation temperature depends on the duration of incubation period preferred; preferred incubations are about 4 hours at 106°-110° F. (41°-43° C.) or 16-18 hours (overnight) at 92° F. (33° C.). Incubation is continued until the desired titratable acidity level is reached. Typically, the acidity level is 1-1.6% in the yogurt portion but the level depends on the final flavor desired in the finished product. The acidity level is not critical to the physical characteristics of the product.

While the yogurt culture is incubating, the sugars and stabilizers are mixed with the proper water level and that mixture is pasteurized. After pasteurization, the resulting sugar syrup is cooled to approximately 90° F. (32° C.).

After the requisite level of acidity has been reached, the yogurt "set" is broken by adding the sugar syrup while stirring. If additional sugar is to be added, i.e., not all the sugar could go into the sugar syrup, it can be added in dry form at this point. The completed soft serve yogurt mix is then cooled to 40° F. (4.5° C.).

The cooled soft serve yogurt is then subjected to freezing and aeration. The aeration is sufficient to reduce the specific gravity, which otherwise has a value greater than unity, to the range of between 0.36 and 0.54; preferably to a value between 0.38 and 0.44. These values of specific gravity of the resultant product correspond to overruns ranging between 100% and 220%, and preferably between 160% and 200%. Beyond the preferred specific gravity range, the product is generally considered acceptable, but outside the wider range the product is considered unsatisfactory with regard to desirable eating properties and extrudability.

The freezing and aeration can, for example, be performed with a conventional ice cream freezer which whips the product while dropping its temperature to below freezing. The whipping and freezing operation is continued until the product has attained the desired specific gravity at a temperature below 24° F., preferably in the range of 15° F. to 20° F. The product is removed from the equipment at this temperature and packaged, after which the packaged product is hardened by reducing the temperature to below 0° F. The freezing and whipping operation can include the injection of gas. The gas can, by way of non-limiting examples, be air, nitrogen, carbon dioxide, nitrous oxide or a combination of these gaseous fluids. The whipping and

freezing step can also be performed by whipping the product to the desired specific gravity within the range stated, typically in the commercially known Oakes brand or Votator brand high-shear whipping equipment, and then blast freezing the whipped product to accomplish the freezing and hardening process in one step. The latter operation can also be carried out with the noted injection of gas under pressure.

The resultant product, with the composition and overrun previously described, possesses the desired physical and organoleptic properties discussed above. It accordingly fully meets the required and desired properties for the new soft serve frozen yogurt. The package for the product can be a closed envelope with an extrusion orifice which the consumer can squeeze to subject the soft serve frozen yogurt to pressure which extrudes the product from the nozzle, much in the way that conventional soft serve frozen yogurt is extruded from a commercial freezer. But the new soft serve frozen yogurt of this invention possesses these properties at home freezer temperatures, whereas conventional soft serve frozen yogurt is dispensed at significantly higher temperatures and utterly fails to exhibit these properties at home freezer temperatures.

EXAMPLE 1

One example of the new soft serve frozen yogurt formulated and processed in the foregoing manner and deemed preferable for practice of the invention is prepared in the foregoing manner. This formulation yields a soft serve frozen yogurt product containing the following final level of constituents by weight.

5.0% Fat
13.0% MSNF
3.8% Fructose
12.5% Sorbitol
8.5% 36 DE Corn Syrup Solids
0.39% Mono-and Diglycerides
0.06% Polysorbate 80
0.25% Avicel RC 591
0.15% Gelatin 225 Bloom
0.075% Locust Bean Gum
0.05% Guar Gum
0.018% Carrageenen
0.183% Salt
4.0% Yogurt Culture
Balance Water

The product is formulated by mixing an incubated yogurt portion with a sugar portion and homogenizing. The yogurt portion consists of:

8.33% Fat, provided as butter fat
21.66% MSNF, provided as milk and milk powder
0.65% Mono-and diglycerides (for example, Durem 207 marketed by the Durkee Company)
0.1% Polysorbate 80
Balance Water

The yogurt mixture is pasteurized for 30 minutes at 180° F. then homogenized at 180° F. using 2000 psi on the first stage and 500 psi on the second stage. The homogenized yogurt mixture is cooled to 110° F., innoculated with yogurt culture, and allowed to incubate until the titratable acidity reaches 1.3%. The preferred yogurt culture consists of a mixture of lactobacillus bulgaricus and streptococcus thermophilus organisms in a 1:1 ratio.

Simultaneously with the incubation of the yogurt portion, the sugar portion is formulated as follows:

9.5% Fructose, provided as crystalline fructose (for example, marketed by Hoffman-LaRoche Company)
31.25% Sorbitol
21.25% 36 DE Corn Syrup Solids (for example, Star Dri 35R marketed by A.E. Staley Co.)
0.625% Microcrystalline cellulose (Avicel RC 591)
0.375% Gelatin 225 Bloom
0.1875% Locust Bean Gum (for example, FL 70/50 marketed by Hercules Company)
0.125% Guar Gum (for example, Hercules FG 60/70)
0.045% Carrageenan (for example, Hercules Genulacta L100)
0.4575% Salt
Balance Water

The sugar portion is pasteurized at 175° F. for a short time then cooled to 90° F.

Two parts of the sugar portion are mixed with 3 parts of the yogurt portion while the mixture is cooled to 40° F. The resulting soft serve yogurt mix is then frozen as previously described to achieve the final product.

EXAMPLE 2

Example 1 illustrated a 5% fat soft serve frozen yogurt product. The present example illustrates a non-fat soft serve frozen yogurt product made using the same process. The formula for the finished product is as follows.

0.0% Fat
11.0% MSNF
3.5% Modified whey protein (for example, Fortein 35 marketed by Foremost Foods)
4.3% Fructose
12.2% Sorbitol
7.0% 36 DE Corn Syrup Solids
3.8% 24 DE Corn Syrup Solids
0.45% Distilled monoglycerides
0.26% Mono- and diglycerides
0.065% Polysorbate 80
0.5% Avicel RC 591
0.35% Gelatin Bloom 225
0.12% Hydroxypropylmethyl Cellulose (for example, Methocel K15M Premium)
0.08% Locust bean gum
0.0135% Carregeenan
0.191% Salt
4.0% Yogurt Culture
Balance Water

The yogurt portion is incubated with the same yogurt culture as in Example 1 after innoculation. The yogurt portion contains:

18.33% MSNF
0.75% Distilled Monoglycerides
0.432% Mono- and Diglycerides
0.108% Polysorbate 80
Balance Water

The sugar portion of the non-fat yogurt mix contains:

29.8% 36 DE Corn Syrup Solids
16.2% 24 DE Corn Syrup Solids
14.9% Fortein 35
2.128% Avicel RC 591
1.49% Gelatin 225 Bloom
0.51% Hydroxypropylmethyl Cellulose
0.34% Locust Bean Gum
0.0574% Carrageenan
0.82% Salt
Balance Water

The non-fat soft serve frozen yogurt illustrated herein requires added dry sugar as well as the sugar portion of the mix. The dry sugar portion consists of:

74.0% Sorbitol
26.0% Fructose

The yogurt breaking process is identical to that described in Example 1 except 3.636 parts of the yogurt portion were mixed with 1.424 parts of the sugar mixture and 1 part of the dry sugar portion.

The product is prepared as described, with an overrun preferred about 160% and 200%.

The soft serve frozen yogurt satisfies the desired deformation and flow properties at home freezer temperatures as discussed above, as well as withstanding prolonged freezer storage. The product accordingly is indeed readily extrudable, by hand pressure on a collapsible pliable container, immediately upon removal from prolonged storage in a home freezer.

TEST EXAMPLE

More extensive tests of the organoleptic and the rheological properties of soft serve-like frozen foods extrudable and coneable at home freezer temperatures have been conducted with a non-yogurt product similar in some respects to the soft serve frozen yogurt product of this invention but is not acidic or yogurt flavored. This frozen dessert, designated below as "test" to distinguish it from the soft serve frozen yogurt product of Examples 1 and 2, was prepared with the following ingredients in the manner described above, taking into account the lack of yogurt culture and the different ingredients.

11% Fat, provided as butter fat
11% MSNF, provided as milk and milk powder
3% Fructose, provided as crystalline fructose (as marketed for example by the Hoffman-LaRoche Company)
10.8% Sorbitol
10.0% Corn Syrup Solids (for example Star Dri 35R as marketed by A. E. Staley Co.)
0.25% Microcrystalline Cellulose (for example Avicel RC591 as marketed by FMC Corporation)
0.15% Gelatin (Bloom strength 225)
0.07% Locust Bean Gum (for example FL 70/50 as marketed by Hercules Company)
0.05% Guar Gum (for example Hercules FG 60/70)
0.02% Carrageenan (for example Hercules Genulacta L100)
0.4% Mono- and Diglycerides (for example Durem 207 as marketed by the Durkee Company)
0.05% Polysorbate 80

The balance of the product was water.

The test product was prepared as described, with an overrun between 160% and 200%, and with 0.2% by weight table salt (NaCl), principally as a flavor enhancer.

Consumer testing of the resultant test dessert has verified that it is at least comparable, if not superior, to presently available commercial soft serve ice cream. The test dessert has been lauded as creamy, smooth and free of burn. Moreover, the dessert well satisfies the desired deformation and flow properties at home freezer temperatures as discussed above, as well as withstanding prolonged freezer storage. The test product accordingly is indeed readily extrudable, as a continuous extrudate, by hand pressure on a collapsible pliable container, immediately upon removal from prolonged storage in a home freezer.

Laboratory tests support the attainment of new and different material properties with the test dessert, and are believed also attained with the soft serve frozen yogurt product of this invention. The test dessert when prepared with an overrun in the order of 200%, was measured to have a moderately low yield value and a relatively high resistance to lateral deformation. It also exhibited an unusually short relaxation time, which is considered to facilitate extrusion to a cone or dish, even by a first time user of the new dessert. In particular, a measurement comparing the test dessert at 0° F. with conventional soft serve at 20° F. determined that the relaxation time of the test dessert is on the order of ten times shorter than that of conventional soft serve. In one particular measurement, for example, the new test dessert exhibited a relaxation time on the order of two seconds, whereas the conventional product, at the higher temperature at which it operates, exhibited a relaxation time on the order of twenty-five seconds. These tests included conventional ice cream at the store freezer temperature of 0° F., but that product was not extrudable under reasonable pressures and hence no corresponding measurement was obtained of relaxation time.

Viscosity and shear thinning tests on the test dessert of the Test Example revealed that the viscosity of the food product, at 0° F., dropped by a factor on the order of two hundred between the unstressed condition and the stress required to obtain extrusion through a 0.62-inch diameter orifice. In the unstressed condition the viscosity was, as desired, sufficiently high to preclude unwanted flow from the extrusion container and to be coneable after recovery from extrusion. The test also established that the test food product has remarkably shear thinning at 0° F.

A series of standard laboratory cone penetrometer measurements was performed on the foregoing test dessert, conventional soft serve, and two different ice creams, one a standard supermarket brand and the other a frozen pudding which contains alcohol. The test dessert product exhibited the lowest yield value. The measured penetration distances were converted to yield values according to the standard formula

$$Y = KL/Z^{1.6}$$

where Y is the yield value in grams per square centimeter, L is the applied cone load in grams, Z is the measured penetration in 1/10 millimeter units, and K is a constant for the particular cone angle.

The accompanying drawing is a semi-log plot of the yield values obtained in this manner for each of the four samples as a function of the temperatures at which the measurements were made. It is noteworthy that the test product, as desired, exhibits a yield value, at the home-freezer temperature range at which it is to be extruded, of the same order of magnitude as the yield value of conventional soft serve at the higher, i.e. 16° F. to 21° F., temperatures at which it is extruded.

A further test determined that the test dessert of the Test Example has flow and deflection properties distinctly different from those of conventional soft serve ice cream, as well as from conventional supermarket ice cream. The test was conducted with the test dessert and with the ice cream at household freezer temperatures, i.e. 0° F., and with the conventional soft serve ice cream at the standard extrusion temperature of 20° F. The supermarket ice cream fractures, rather than bends, when subjected to gravity or other loading force. Con-

ventional soft serve ice cream exhibits progressive plastic bending under these conditions. It hence deforms progressively until the load is removed. The new test dessert, on the other hand, exhibits a distinctly elastic deformation, but of relatively small magnitude. Further, the tests indicate that the test dessert is plastic while under the shear loading for extrusion, but reverts quickly to elastic behavior when the load is removed. Conventional soft serve ice cream, on the other hand, appears to be plastic under all loading conditions when in the normal extrusion temperature range of 16° F. to 21° F.

In a further test on a chocolate flavored variation of the Test Example, samples were initially hardened, subjected to prolonged tempering, i.e., at temperatures not lower than 15° F. for over eighty hours, and then re-hardened. Samples that underwent the full tempering period appeared identical to samples that were subjected to shorter tempering and to samples that were maintained throughout at the hardened condition. The samples thus withstood the tempering, which is considered similar to that likely to be incurred in commercial distribution, without any appreciable deterioration, including without loss of volume, loss of the fine air cell structure, or loss of the fine ice crystal structure.

Extrusion of the soft serve frozen yogurt product of Examples 1 and 2 and of the foregoing test product from a collapsible package and coiling the continuous extrudate onto a cone has demonstrated that the ease of extrusion, the shear-responsive fluidity, the relaxation time and the lateral resistance for successful coneability exist to a similar extent with both the soft serve frozen yogurt and the test product. These observations and demonstrations indicate that the rheological properties of the test dessert, as the foregoing measurements exemplify, are comparable to those of the soft serve frozen yogurt.

It will thus be seen that the objects set forth above, including those made apparent from the preceding description, are efficiently attained. Since certain changes may be made in the composition and the product set forth, and in carrying out the foregoing process without departing from the scope of the invention, it is intended that all matter contained in the above description and shown in the accompanying drawing be interpreted as illustrative and not in a limiting sense.

It is also to be understood that the following claims are intended to cover all of the generic and specific features of the invention herein described, and all statements of the scope of the invention which, as a matter of language, might be said to fall therebetween.

Having described the invention, what is claimed as new and secured by Letters Patent is:

1. A frozen yogurt product

A. characterized at least in part by being extrudable and coneable at near 0° F. for serving by extrusion at home freezer temperatures,

B. consisting essentially, by weight in the absence of significant weight by flavorings, of

(1) edible triglycerides in a range from 0% to 5%,

(2) protein in a range from 4% to 5.5%,

(3) water in a range of 50% to 60%,

(4) added saccharides in a range from 22% to 30% and including plural saccharides selected from the group consisting of sorbitol, fructose, dextrose, corn syrup, mannitol and sucrose,

(5) stabilizers in a range from 0.25% to 1.3% and including at least a first stabilizer selected from the group consisting of guar gum, locust bean gum, tara gum, propylene glycol alginate, sodium carboxymethyl cellulose, and other cellulose ethers; a second stabilizer selected from the group consisting of microcrystalline cellulose and cellulose fibers; and a third stabilizer selected from the group consisting of gelatin, xanthan gum, carrageenan, pectin and sodium alginate,

(6) emulsifiers in a range from 0.45% to 0.775% and including at least a first emulsifier selected from the group consisting of mono- and diglycerides and distilled monoglycerides, and a second emulsifier selected from the group consisting of polysorbate 65, polysorbate 80, and ethoxylated monoglycerides, and

(7) yogurt culturing means for converting the product to yogurt; and

C. having a specific gravity in the range of between 0.36 and 0.54.

2. A frozen yogurt product according to claim 1 further characterized in that said saccharides include at least three saccharides selected from the group consisting of sorbitol, fructose, dextrose, corn syrup, mannitol, and sucrose.

3. A frozen yogurt product according to claim 1 further characterized in that said saccharides consist essentially of sorbitol, fructose and corn syrup.

4. A frozen yogurt product according to claim 1 further characterized in that said stabilizers consist essentially of microcrystalline cellulose, locust bean gum, guar gum, hydroxypropylmethyl cellulose, gelatin, and carrageenan.

5. A frozen yogurt product according to claim 1 further characterized in that said emulsifiers consist essentially of mono- and diglycerides, distilled monoglycerides and polysorbate 80.

6. A frozen yogurt product according to claim 1 wherein the yogurt culturing means comprises lactobacillus bulgaricus and streptococcus thermophilus organisms.

7. A frozen yogurt product according to claim 6 further characterized in that

A. said edible triglycerides are provided at least in major part by butter fat,

B. said protein is provided at least in major part by non-fat milk solids,

C. said stabilizers consist essentially of microcrystalline cellulose, locust bean gum, guar gum, hydroxypropylmethyl cellulose, gelatin and carrageenan,

D. said emulsifiers consist essentially of mono and diglycerides, distilled monoglycerides and polysorbate 80.

8. A frozen yogurt product according to claims 1 or 7 further characterized in that said specific gravity is in the range between 0.38 and 0.44.

9. A frozen yogurt product according to claim 7 further characterized in that said saccharides consist essentially of sorbitol, fructose, and corn syrup.

10. A frozen yogurt product according to claim 7 further characterized in that said stabilizers are present in a range between 0.5% and 1.1%.

11. A frozen yogurt product extrudable and coneable at near 0° F. for serving by extrusion at home freezer temperatures,

A. said product comprising, by weight in the absence of significant weight of flavorings, edible triglycer-

ides in a range from 0% to 5% and provided at least in major part by butter fat, protein in a range from 4% to 5.5% and provided at least in substantial part by non-fat milk solids, about 4% yogurt culture, and water, and

B. said product further consisting essentially of a saccharide system in a range of 22% to 30% and including fructose, sorbitol and corn syrup,

C. a stabilizer system in a range from 0.5% to 1.3% and consisting essentially of microcrystalline cellulose, locust bean gum, guar gum, hydroxypropylmethyl cellulose, gelatin and carrageenan, and

D. an emulsifier system in a range from 0.45% to 0.775% and consisting essentially of mono- and diglycerides, distilled monoglycerides and polysorbate 80, and

E. having a specific gravity in a range between 0.36 and 0.54.

12. A frozen yogurt product extrudable and coneable at near 0° F. for serving by extrusion at home freezer temperatures and comprising, by weight in the absence of significant weight of flavorings, 5% edible triglycerides provided at least in part by butter fat, 13% milk solids not fat provided at least in part as milk and milk powder, 3.8% fructose, 12.5% sorbitol, 8.5% corn syrup solids, 0.25% microcrystalline cellulose, 0.15% gelatin bloom strength 225, 0.075% locust bean gum, 0.05% guar gum, 0.018% carrageenan, 0.39% mono- and diglycerides, 0.06% polysorbate 80, 0.183% salt, 4% yogurt culture consisting essentially of equal parts of lactobacillus bulgaricus and streptococcus thermophilus organisms, and the balance consisting essentially of water, said product being prepared with an overrun between 100% and 200%.

13. A frozen yogurt product according to claim **12** further characterized in that said overrun is between 160% and 200%.

14. A non-fat frozen yogurt product extrudable and coneable at near 0° F. for serving by extrusion at home freezer temperatures and comprising, by weight in the absence of significant weight of flavorings, 11% milk solids not fat provided at least in part by skim milk and milk powder, 3.5% modified whey protein, 4.3% fructose, 12.2% sorbitol, 7.0% 36 DE corn syrup solids, 3.8% 24DE corn syrup solids, 0.45% distilled monoglycerides, 0.26% mono- and diglycerides, 0.065% polysorbate 80, 0.5% microcrystalline cellulose, 0.35% gelatin bloom strength 225, 0.12% hydroxypropylmethyl cellulose, 0.08% locust bean gum, 0.0135% carrageenan, 0.191% salt, 4% yogurt culture consisting essentially of equal parts of lactobacillus bulgaricus and streptococcus thermophilus, and the balance consisting essentially of water, said product being prepared with an overrun between 100% and 200%.

15. A frozen yogurt product according to claim **14** further characterized in that said overrun is between 160% and 200%.

16. A process for preparing a frozen yogurt product extrudable and coneable by extrusion at temperatures near 0° F., said process comprising the steps of:

A. performing a first constituent mix comprising
about 8.33% fat,
about 21.66% milk solids not fat,
about 0.65% mono-and diglycerides,
about 0.1% Polysorbate 80, and
water to 100%;

B. the pasteurizing said first constituent mix:

C. homogenizing said pasteurizing first constituent mix;

D. cooling said homogenized first constituent mix;

E. innoculating said first constituent mix with yogurt culture;

F. incubating said innoculated first constituent mix until the titratable acid is, substantially between 1 and 1.6%;

G. forming a second constituent mix comprising (saccharides, stabilizers, salt, and water)
about 0.9% fructose
about 31.25% sorbitol,
about 21.25% 36 DE corn syrup solids,
about 0.625% microcrystalline cellulose,
about 0.375% gelatin 225 bloom,
about 0.1875% locust bean gum,
about 0.125% guar gum,
about 0.045% carrageenan,
about 0.4575% salt, and
water to 100%;

H. pasteurizing said second constituent mix:

I. cooling said pasteurized second constituent mix to about the incubation temperature of said innoculated first constituent mix;

J. combining said innoculated first constituent mix with said second constituent mix in a ratio of 3 parts first constituent mix to 2 parts second constituent mix; and

K. freezing and aerating said final product.

17. The process of claim **16** further comprising the step of adding a third constituent mix comprisitig dry sugars to said first and second constituent mixes prior to freezing.

18. A process for preparing a frozen yogurt process extrudable and coneable by extrusion at temperatures near 0° F., said process comprising the steps of:

A. forming a first constituent mix comprising:
about 18.33% milk solids not fat,
about 0.75% distilled monoglycerides,
about 0.43% mono-and diglycerides,
about 0.108% Polysorbate 80, and
water to 100%;

B. pasteurizing said first constituent mix:

C. homogenizing said pasturized first constituent mix;

D. cooling said homogenized first constituent mix;

E. innoculating said first constituent mix with yogurt culture;

F. incubating said innoculated first constituent mix until titratable acid is substantially between 1 and 1.6%;

G. forming a second constituent mix comprising:
about 29.8% 36 DE corn syrup solids,
about 16.2% 24 DE corn syrup solids,
about 14.9% modified whey protein,
about 2.128% microcrystalline cellulose,
about 1.49% gelatin 225 bloom,
about 0.51% hydroxypropylmethyl cellulose
about 0.34% locust bean gum,
about 0.0574% carrageenan.
about 0.82% salt, and
water to 100%

H. pasteurizing said second constituent mix:

I. cooling said pasteurized second constituent mix to about the incubation temperature of said innoculated first constituent;

J. combining said innoculated first constituent mix with said second constituent mix;

K. adding a third constituent mix comprising about 74% sorbitol and about 26% fructose to the mix of step J wherein the ratios of the first mix to second mix to third mix in said frozen yogurt are about 3.636:1.424:1, respectively; and

L. freezing and aerating said final product.

* * * * *

UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 4,427,701
DATED : January 24, 1984
INVENTOR(S) : Robert G. Morley

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

Column 3, line 19, change "bondable" to --bendable--.

Column 16, line 8, change "0.9%" to --9.5%--.

Abstract, line 5, delete "is incubated in multiple stages".

References cited, change "Dem et al." to --Dea et al.--.

References cited, change "Den et al." to --Dea et al.--.

Column 1, line 9, before "228,557" change "Nos." to --No.--.

Column 1, line 9, after "now U.S. Pat." change "Nos." to --No.--.

Column 1, line 10, add --Ser. No.-- before "228,550".

Column 14, line 51, add --and-- after "carrageenan".

UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 4,427,701

DATED : January 24, 1984

INVENTOR(S) : Robert G. Morley

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 15, line 67, delete "pasteurizing" after "said".

Column 16, line 30, change "process" to -- product--.

Column 16, line 39, delete "pasturized" after "said".

Signed and Sealed this

Ninth Day of *July 1985*

[SEAL]

Attest:

DONALD J. QUIGG

Attesting Officer *Acting Commissioner of Patents and Trademarks*